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CONTENTS

Tax the Cooperatives. *By Julian Chase* 15
The SAE Holds Forth. *By Joseph Geschelin* 17
Clark's New Laboratory for Testing Axles and Transmissions 20
Golden Jubilee 22
Indianapolis Race 23
Underpass Shaving Features Wisconsin Axles Production of Gears and Pinions. *By Perry L. Adams* 24
High speed production of Automobile Generator Frames by Automatic Metallic Arc Welding. *by W. B. Horton* 27
Mechanical Details of 1947 Studebaker 28
Performance Characteristics of BMW 003 Turbojet and Comparison with Jumo 004. Part one. *By W. G. Lundquist and R. W. Cole* 30
Essentials of Good Purchasing. *By Robert Y. Matley* 33
Abstracts of Papers Presented at the SAE Summer Meeting 34
Bristol 170 Freighter 40
Getting the V-2 into Action 42
British Motor Industry's Jubilee. *By Charles Fothergill* 43
New Production and Plant Equipment 44
Airbriefs. *By Robert McLarren* 46
New Products for Aircraft 48
Observations. *By Joseph Geschelin* 50
New Products 52
News of the Industry 54
Calendar of Coming Events 62
Advertisers' Index 186

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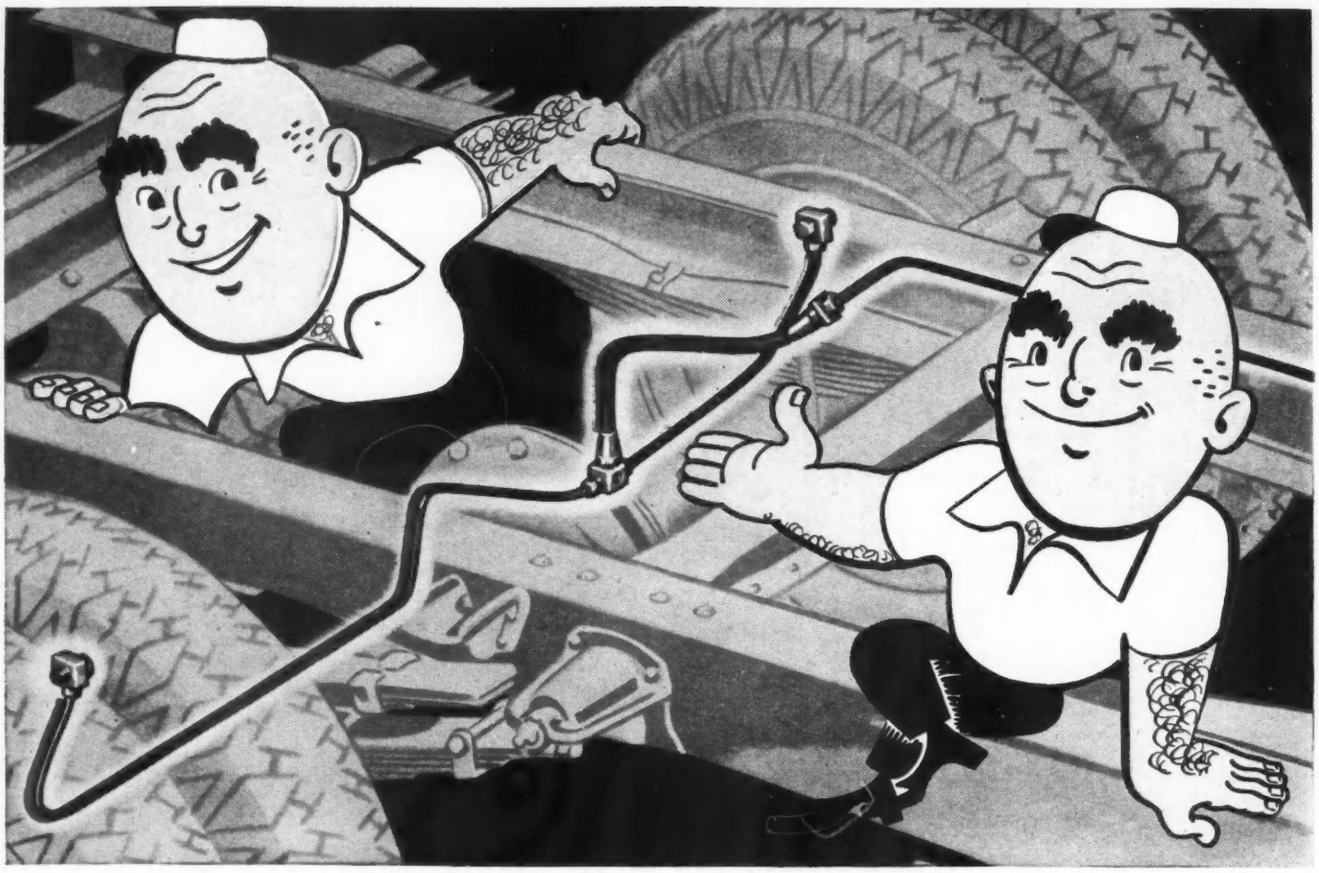

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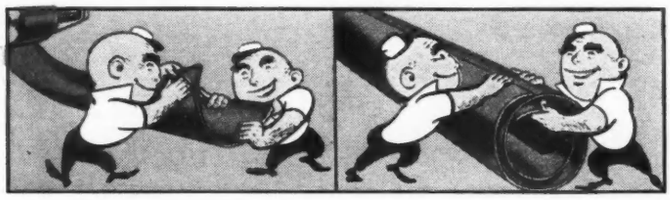

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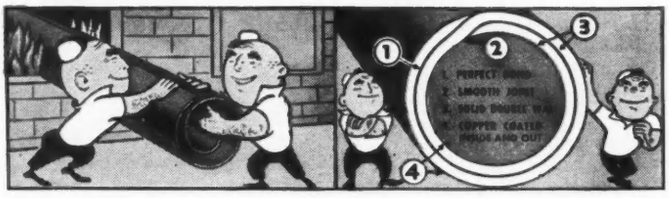

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Tax the Cooperatives

by Julian Chase

LABOR unionism is business. It is BIG business. It is monopolistic business which is domineeringly powerful politically. It is daily stretching out its long and brawny arms to grasp still more power. It pays little or no income taxes.

Cooperative enterprise is business. It is BIG business. It is steadily growing and becoming more nearly monopolistic. It is powerful both economically and politically and, in both respects, its power is increasing. It pays little or no income taxes.

Only over-enthuisastic optimists will dare to hope that our politicians will soon have the courage to bring labor unions under the income tax laws. There is, however, some hope that something may, at some not too distant day, be done to compel cooperatives to pay the taxes that they should. If that does come about, at least three highly important developments will follow. The tax base will be beneficially broadened, the present tax-payers' load may be correspondingly lightened or total taxes substantially increased, and the co-ops will be placed on a more equitable competitive basis.

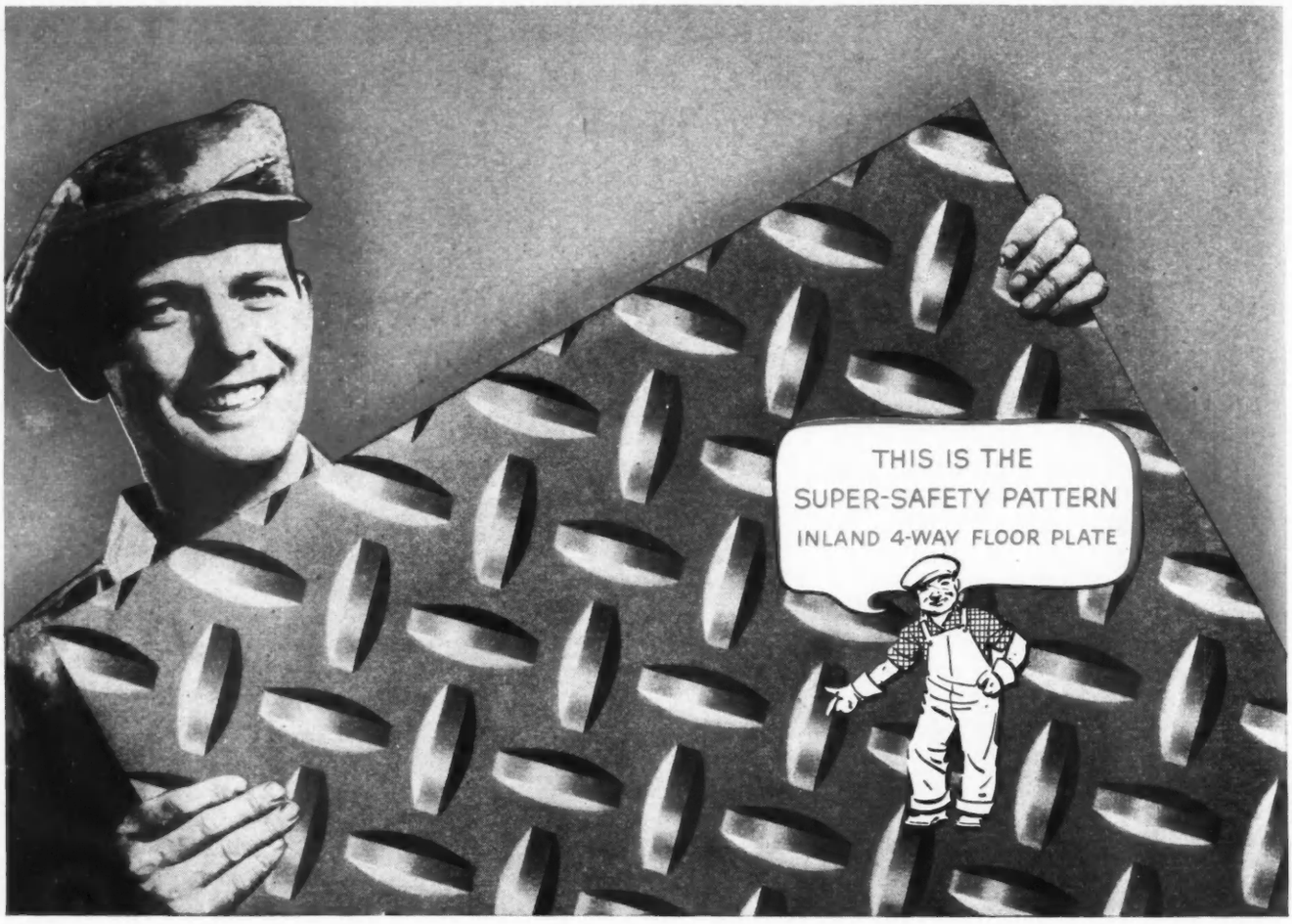
Cooperative enterprise is business. It produces. It buys. It distributes. It sells. It makes a profit which, like that of all other business is the difference between income and outgo. But the cooperatives do not call their profits profits. They call them "savings," and they boast about the size of their "savings." They well may do so for it has been estimated conservatively that the aggregate business of cooperatives reached a volume of close to $12 billions in 1945.

According to the National Tax Equality Association, an analysis of the statements of 17 large cooperatives showed that 31 per cent of their "savings" was paid out to members in cash patronage dividends or in stock and 69 per cent was held as retained earnings for expansion in a way not permitted to tax-paying corporations. The Cooperative Grange-League Federation, as another example, paid out 10 per cent of its "savings" and retained 90 per cent. Of the total earnings. less than one-fifth of one per cent went to the payment of Federal income taxes.

"We pay all the taxes that the law requires," say the cooperatives. And so, presumably, they do. That is why the law should be changed. As things are now, cooperatives are inadequately taxed, they tend to destroy tax-paying business and they grow through what amounts to government subsidy and what is actually special privilege under the law. It is true enough to say that they pay no taxes. It is literally true to say they kill off tax-payers. Examples are plentiful but here are just two.

The Red River Lumber Co. of California formerly paid approximately $900,000 a year in Federal income taxes. It was bought by a subsidiary of the California Fruit Growers' Exchange. The U. S. Treasury now has to find elsewhere the taxes it lost through that transaction which is only one of many

(*Turn to page* 82, *please*)



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2. *Longer wear.* Inland floor plate is rolled from tough, open hearth steel with high wear resisting qualities.

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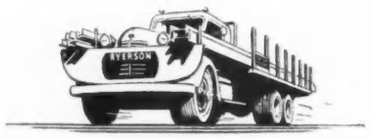
Then you get the additional advantage of a continuous pattern that is pleasing in appearance; matches whether laid side to side or end to end and permits sweeping and drainage in four directions.

Inland 4-Way Floor Plate is available for quick delivery from Ryerson Steel-Service Plants, in two pattern sizes and several thicknesses. Write for catalog and samples too if you care for them.

Joseph T. Ryerson & Son, Inc. Steel-Service Plants at: Chicago, Milwaukee, Cleveland, Cincinnati, St. Louis, Detroit, Philadelphia, Pittsburgh, Buffalo, Boston, New York.



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The SAE Holds Forth

at French Lick Springs

By Joseph Geschelin

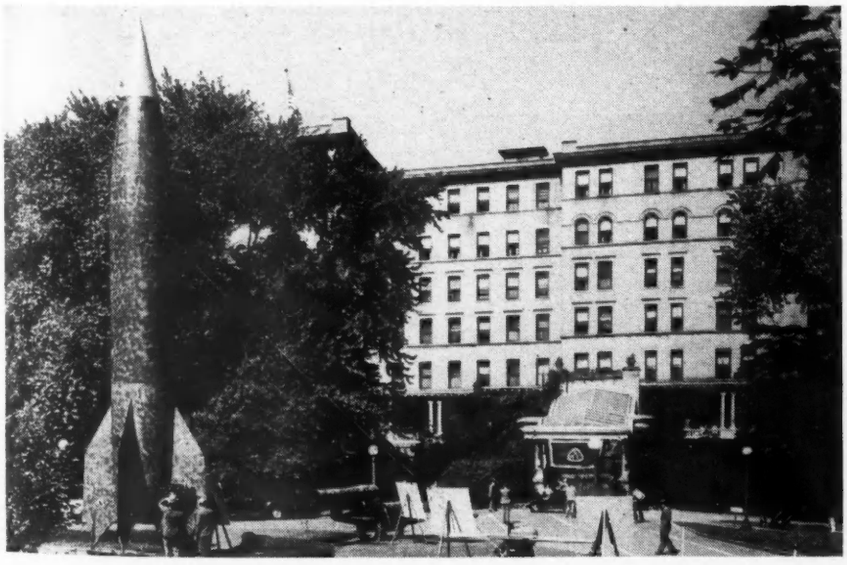
OVER 950 members, wives, and guests participated in the SAE Summer Meeting at French Lick, the first held since 1941. Judged by attendance alone, it was the biggest meeting in 10 years or more. Moreover, by coincidence the session was able to join in the celebration of the Golden Jubilee which was under way concurrently in Detroit. One of the features was an antique car parade and exhibit, many of the cars being contributed by the Thompson Products Album of Old Cars, courtesy of F. C. Crawford, president.

Reminiscent of the days before the war was the old-fashioned Field Day with "fun for all and all for fun." It served as an excellent foil for the reminders of the war—Stephen J. Zand's graphic picture of the strategic bombing of Germany and Germany's treatment of Holland, as well as the outdoor exhibit of captured enemy aircraft equipment displayed by the Collection Division, Air Technical Intelligence, Headquarters Air Materiel Command. Here were examples of the deadly Nazi and Jap jet-propelled fighters and bombers, the Kamikazi, and other equipment that made the news only a short time ago.

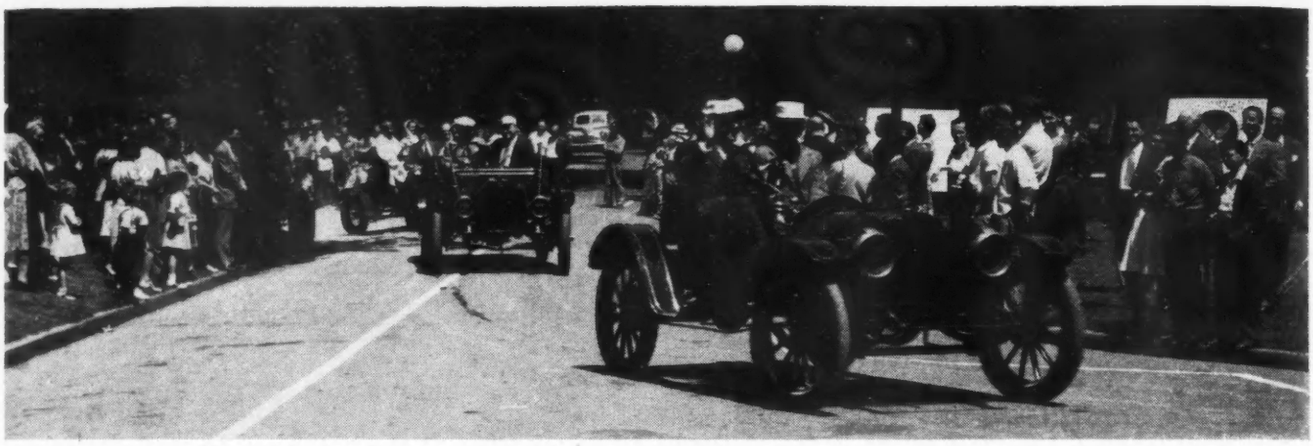
Abstracts of technical papers presented at this meeting will be found in this and succeeding issues. But at this writing it is of interest to comment briefly on some of the more important discussion of a sampling of the sessions. Surely one of the dramatic incidents was the paper on an independent four-wheel suspension using rubber torsion springs presented by A. S. Krotz and his associates of the B. F. Goodrich Co. For here was a project which involved the complete development of a new suspension system together with associated mechanism such as a unique hydraulic steering gear, and a new swinging rear axle, followed by the building of the new vehicle, including a hand-built body and the delivery of the car at French Lick in shape for road demonstration. The paper can be considered as far and above the usual speculative or theoretical discussion of advanced principles.

Just as a side issue we learned off-the-record of development work by another organization in the field of suspension not only for passenger cars but for heavy duty vehicles as well.

Some lively discussion was evoked by Earl Bartholomew's paper on the "Potentialities of the new Fuels in the Design of Passenger Car Engines." R. W. Goodale, Standard Oil Co. of California, said that on the



In front of the French Lick Springs Hotel, where the SAE held its technical sessions and social gatherings during the six days. At the left is a V-2 rocket, which was part of the exhibit of German and Japanese warplanes and weapons.



The parade of antique cars attracted large crowds.

Engineers studied enemy aircraft and automotive engines and equipment which were displayed on an extensive scale.

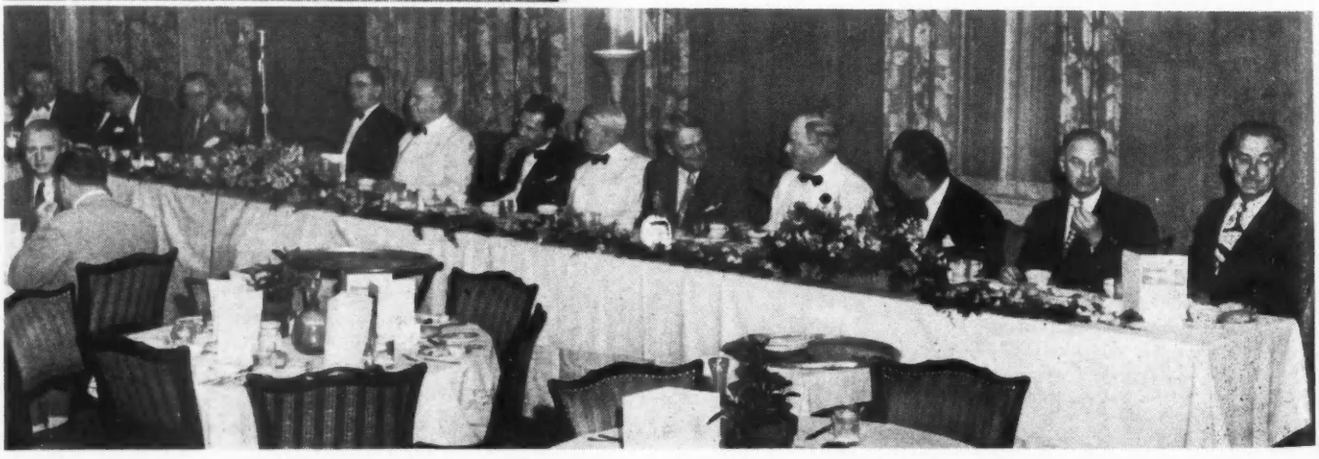
The first installment of abstracts of papers presented at this meeting begins on page 34.

West Coast they have marketed heavy leaded fuels of the range mentioned in the paper. Use of these fuels brought about some difficulties with valves and pistons, serious enough to warrant special attention. Mr. Bartholomew advised that such problems had been encountered during the war in stationary equipment running at constant speed and had been licked by changes in engine design.

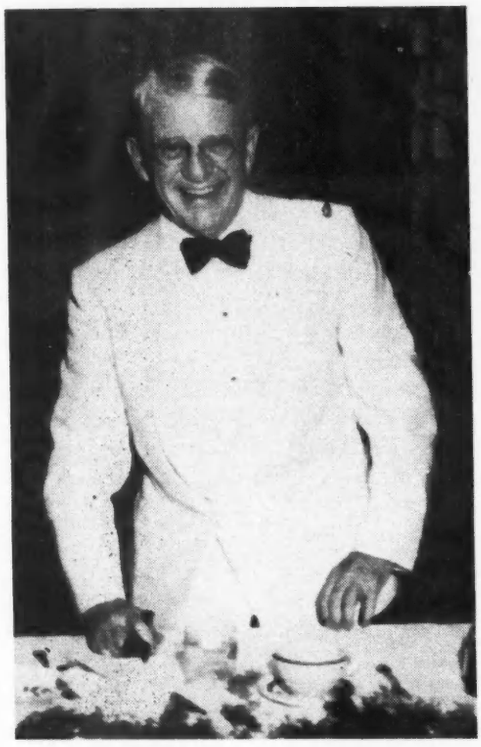
Dr. J. B. Hill, Sun Oil Company, pointed to the immediate trend to fuels of high boiling point—hence lower volatility—as a product of catalytic cracking processes and explained that this, necessarily, affects the warm-up period. Although engine design has trended

(Left) Many had a good time at the field day of races and other contests. A large number participated in golf and tennis.

(Below) At the dais President Buckendale was flanked by past presidents and other prominent SAE members. Seated right to left—W. B. Stout (pres. in 1935), J. M. Crawford (1945), Mac Short (1943), H. T. Woolson (1937), John H. Hunt (1927), Col. H. W. Alden (1912 and 1923), Dr. S. J. Zand—speaker, Carl G. A. Rosen—toastmaster, President Buckendale, B. B. Bachman (1922), D. G. Roos (1934), Ralph R. Teetor (1936), A. W. Herrington (1942), John A. C. Warner, Secretary-General Manager.



(Right) L. Ray Buckendale, SAE president, in welcoming members and guests to the first summer meeting of the Society since 1941, reflected on the past—"This year is also the Golden Jubilee year of the automotive industry . . . Looking back through the years, we salute the pioneers who started this great industry."



(Left) Col. Herbert W. Alden, one of the 50 founder members of the SAE and twice its president, was given an ovation by the large crowd. He collaborated with Percy Maxim in 1895 in designing a three-wheeled car.

away from hot-spot manifolds in recent years, the incidence of high boiling point fuels may reverse the trend and lead to facilities for improving warm-up at low ambient temperatures.

Alex Taub presented some interesting information regarding the design philosophy expressed in the Mathis three-wheel front drive car. The objective of the body design is shape as contrasted with the usual conception of line form. The basic shape is taken as the ellipse and this is carried out in each plane and for each element. It is claimed that with a four-cylinder, 40 hp engine, now being developed by Taub, the American version of the Mathis will have a fuel economy of 55 to 60 mpg. Incidentally, the rolling resistance of the car is only about four horsepower at 60 mph while wind resistance is down to nine horsepower at the same speed.

Much has been said in the last few years concerning the possible use of plastic transparencies for glazing motor cars. The result of extensive tests of Lucite, Plexiglas, and an Allyl composition—C R-39—were presented by George B. Watkins of Libbey-

(Turn to page 94, please)

George P. Dorris (at the wheel) and A. L. Dyke, automobile pioneers, came to the meeting from St. Louis, Mo., in this 1902 St. Louis horseless carriage, a Boston model now equipped with modern tires and sealed beam headlights. Dorris was vice president of the St. Louis Motor Carriage Co. which built this car. In 1905 he organized the Dorris Motor Car Co. which continued in business until 1926. Dyke sold St. Louis cars and is the author of automobile maintenance books. The car has a single cylinder 5¼ in. bore by 6 in. stroke engine and a sliding gear transmission submerged in oil in the crankcase. The exhaust valve is operated mechanically and the automatic intake valve has its lift controlled by a cam arrangement that enables the driver to regulate the engine speed. The 210-mile trip from St. Louis was made in 1½ days. Speed was 20 to 30 mph and fuel mileage 20 mpg.

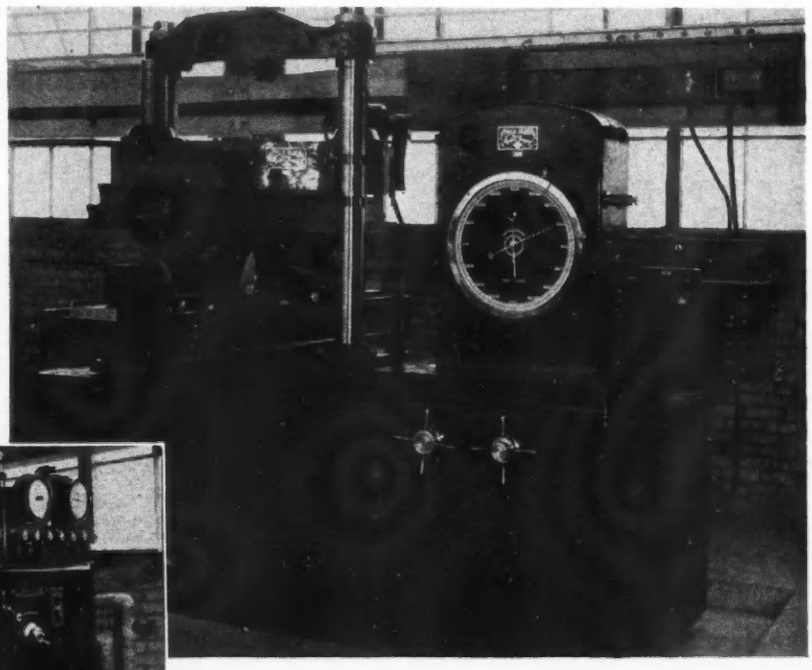
Clark's New Laboratory

for Testing Axles and

CLARK EQUIPMENT Co., Buchanan, Mich., one of the leading producers of axles and transmissions for commercial and heavy duty vehicles, has developed an outstanding mechanical laboratory which was placed in operation recently. Its objective is to conduct extensive testing of axles, transmissions and other products produced by Clark's several divisions; also to isolate elements of over-design in the interest of cost economy or under-design to improve service life, and in general to achieve the goal of proper balance of performance and service life. The laboratory is housed in a newly erected modern building 60 ft wide, 220 ft long.

Dwarfing all other equipment is the new General Electric Co. dynamometer set-up, which is unique in both size and the degree to which electronic control is utilized. As shown in the illustration, the installation consists of three principal stations, a 300-hp motoring unit and two 220-hp absorption units. The layout was primarily engineered for the testing of axles, transmissions, or combinations thereof, for accurate determination of the mechanical efficiency, gear life, loading, etc. The arrangement is flexible in that the motoring and absorption units can be placed at will on the T-shaped beds, with either right angle drive or tandem arrangement of the absorption units. The bed-rail installation for the dynamometers is in the form of 12-ft T-slot sections set in nine-ft depth of concrete. The main bed-rail line is 60 ft long and the side leg 24 ft long.

The dynamometer control is a constant armature current system. Power is taken from the a-c utility line at 2300 volts, with the generator of the motor-generator set maintaining armature current constant

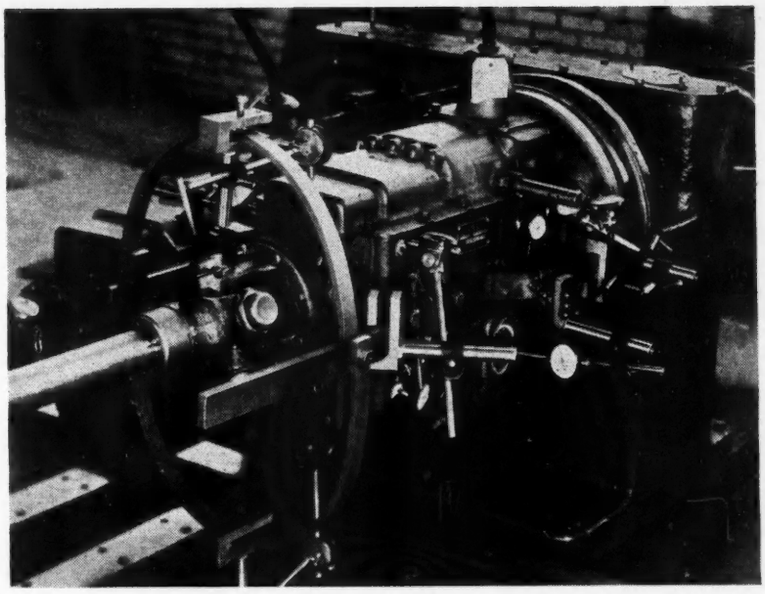


(Above) Used in conjunction with the fatigue testing machine, this universal hydraulic type Tinius-Olsen machine has a capacity of 160,000 lb and is fitted with an electronically-operated load holding device

(Left) First example of unique, vertical type hydraulic testing machine for fatigue, torsion, and bending tests of axles, housings, and axle shafts. The hydraulic ram will deliver 4000 lb.

and providing the power necessary to overcome losses in the system. All speed and torque functions are controlled through field strength. The equipment is electronically controlled through separate amplidyne exciters for the fields of each dynamometer and the generator. It is operationally possible to accomplish the following results:

(A) Maintain constant input torque and hold constant output speed. (Simulating engine input).



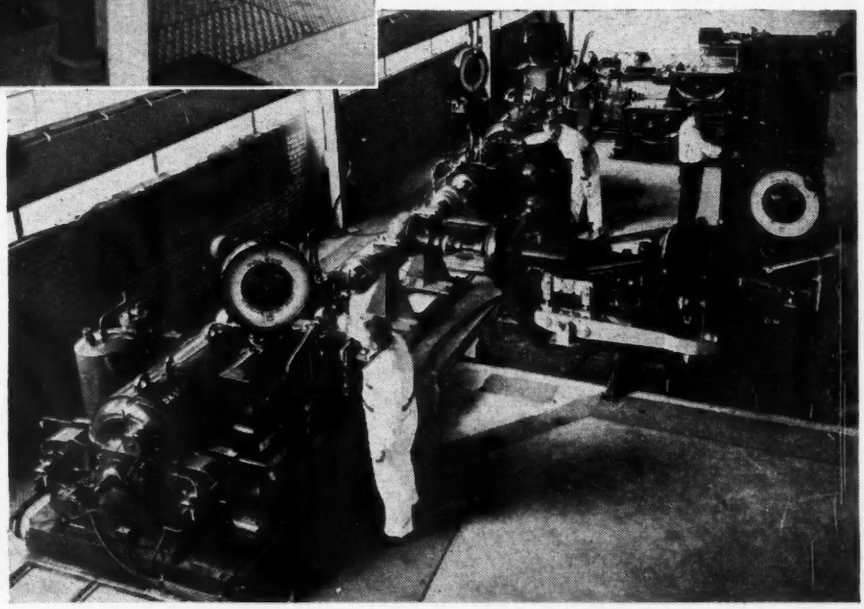
Close-up of one station of the familiar four-square testing machine used for transmission and axle testing

(B) Maintain constant input torque and provide loading equivalent to "road-load" which is the combination of constant torque (grade) and torque varying with speed (windage).

(C) Maintain constant input speed and constant output torque.

(D) Maintain constant input and output speeds. This

(*Turn to page* 84, *please*)



(Above) Water-cooled prony brake absorption type chassis dynamometer is used for testing truck and bus chasses, gives accurate data on draw bar pull and over-all mechanical efficiency

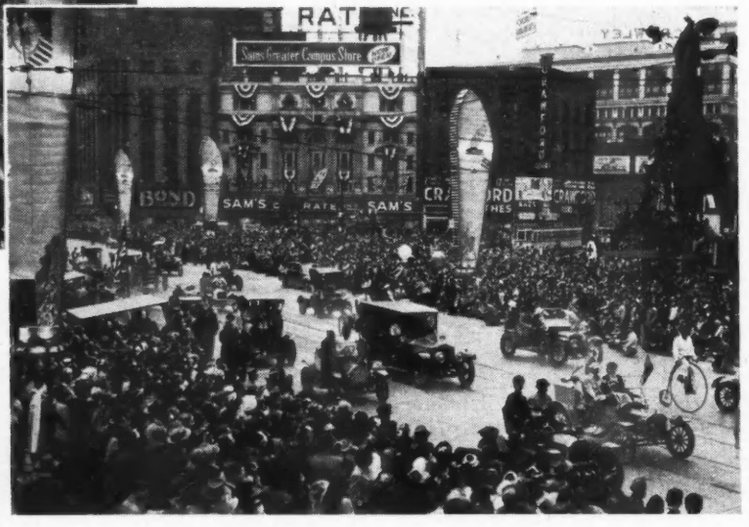
(Right) This enormous General Electric dynamometer dominates the scene in the new Clark Equipment laboratory. Unique both in size and degree to which electronic control is utilized, the dynamometer is used for the testing of axles and transmissions, and can be adapted to the testing of combinations of axles and transmissions with engines.

(Above) The twelve honored pioneer car builders, parts makers, dealers and workers and their awards. Press Assoc. photo

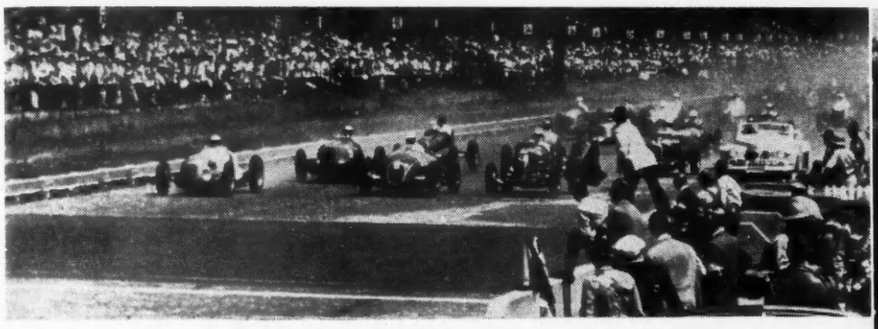
Golden Jubilee

(Above) The Jubilee Queen "split an atom" and unveiled the Jubilee symbol in the opening ceremonies of the celebration.

(Above) Queen Mary Grace Simescu and her attending princesses float by surrounded by footmen. Press Assoc. photo



(Right) Between mammoth pylons on a street of gold the cars of years gone by parade on Woodward Avenue. Press Assoc. photo

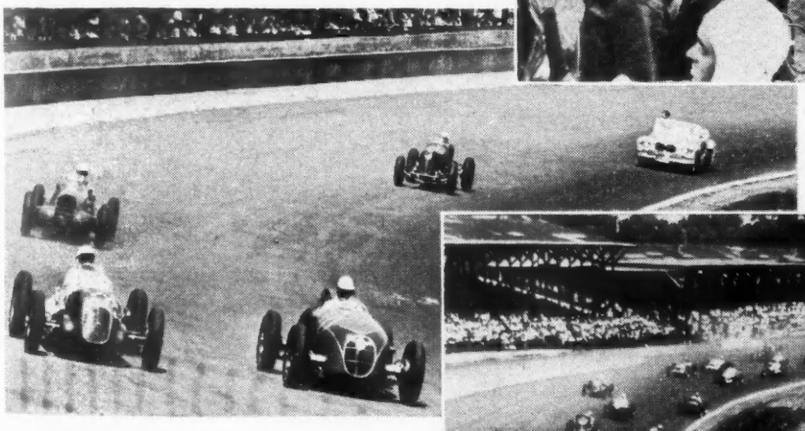


(Above) Well bunched after the preliminary lap the racers are off on their grind at the dropping of the starting flag.

Indianapolis Race

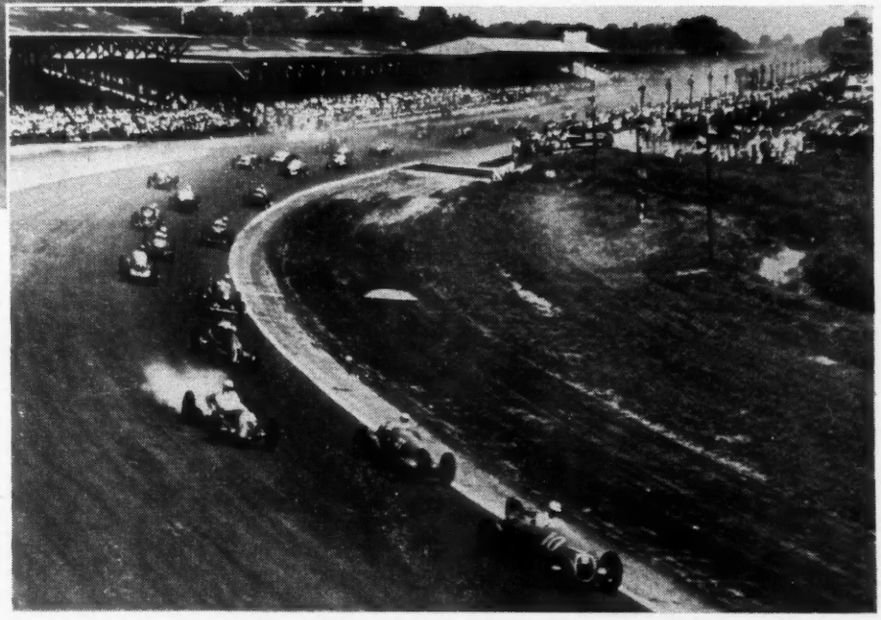
(Above) George Robson in the Thorne Engineering Special (No. 7) with an average speed of 114.82 mph gets the checkered flag.

(Right) Spectators came on two wheels as well as on four and jammed the gates before the race began.



(Above) At the right may be seen the pacing car piloted by Henry Ford II just after its job was done.

Acme photo



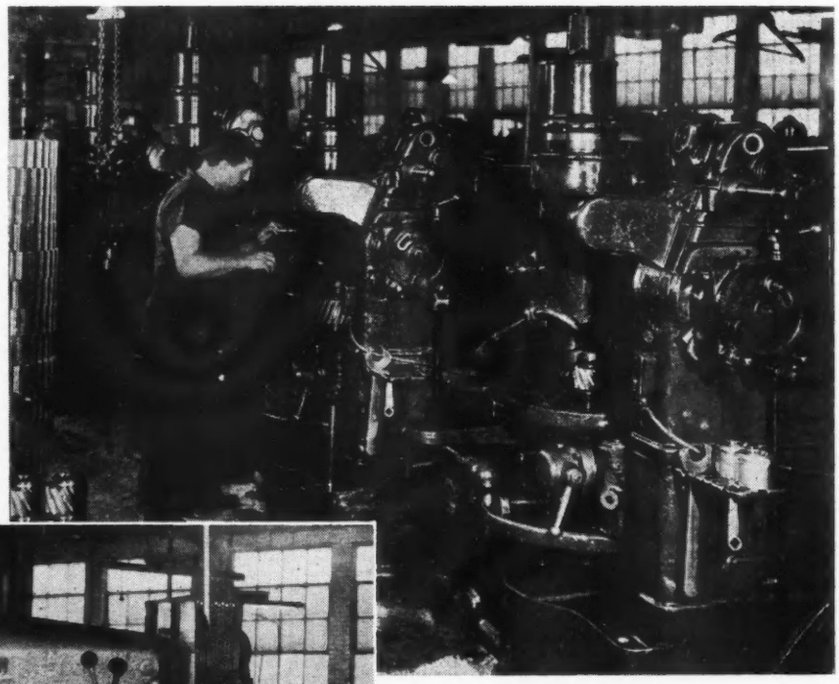
(Right) The thirty-three contestants stretched out at the first turn with the Twin-Coach Special (No. 10) in the lead.

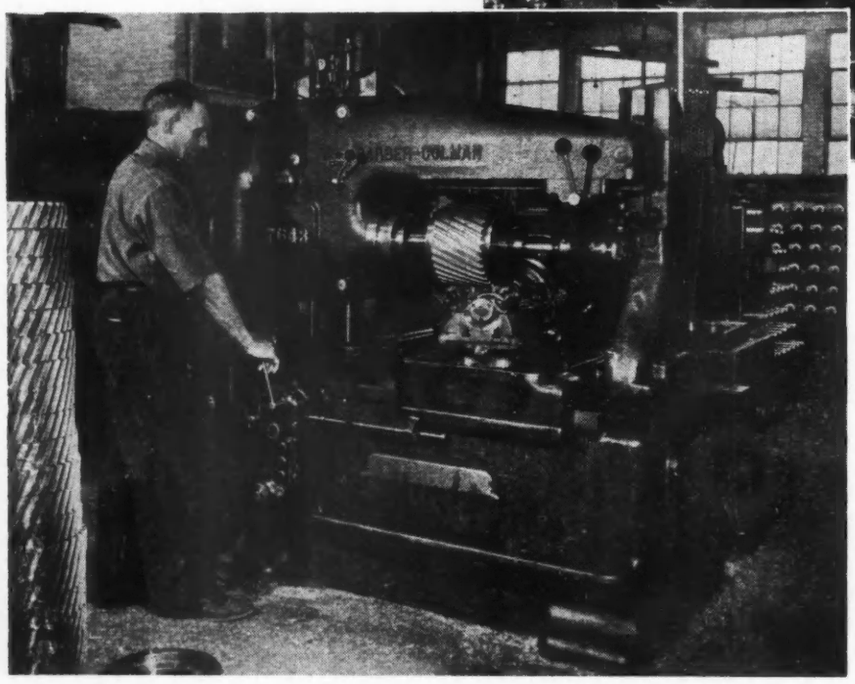
Underpass Shaving *Features Wisconsin*

SINCE the introduction of shaving into the gear manufacturing cycle, including the curve-shaving of pinions—and particularly since the underpass method of shaving has been adopted, Wisconsin Axle Division of Timken-Detroit Axle Co. has not only been able to reduce manufacturing time and costs but has also been able to improve gear quality with respect to involute form, accuracy of tooth spacing, correction of lead errors and mating contact between gears. These improvements result in corresponding improvements in the service life and quietness of the heavy duty gears which Wisconsin produces for truck axles, tractor transmissions, etc. These gears include helicals, spur gears and occasionally herringbone gears and pinions, ranging from 3 to 12 diametral pitch and with pitch diameters ranging from 3½ to 16½ in. Face widths run all the way from ⅞ to 5 in.

Although virtually all of Wisconsin Axle's gears are "large heavy duty" gears, tolerance specifications are extremely close in order to assure maximum operating satisfaction. Similarly, of the many improvements in gear production procedure incorporated through the years by Wisconsin Axle, the ones considered most important by the company are those relating to obtaining of higher precision gears. These include constant inspection through production and holding gear blanks themselves to within close limits; installation of a modern gear laboratory for checking leads, involute

By Perry L. Adams





(Above) Semi-finishing gears on Fellows Gear shapers with Michigan pre-shave shaper cutters. The large gear in the machine at the left is being semi-finished after hobbing. The small gear on the machine at the right is a shoulder gear and previously rough cut on another Fellows gear shaper.

(Left) Rough cutting helical gears (three at a time) on Barber Coleman hobbing machines equipped with Michigan pre-shave type hobs.

Axle's Production of Gears and Pinions

tooth form, spacing, eccentricity and mating of gears; and the recent adoption of underpass shaving to obtain higher precision.

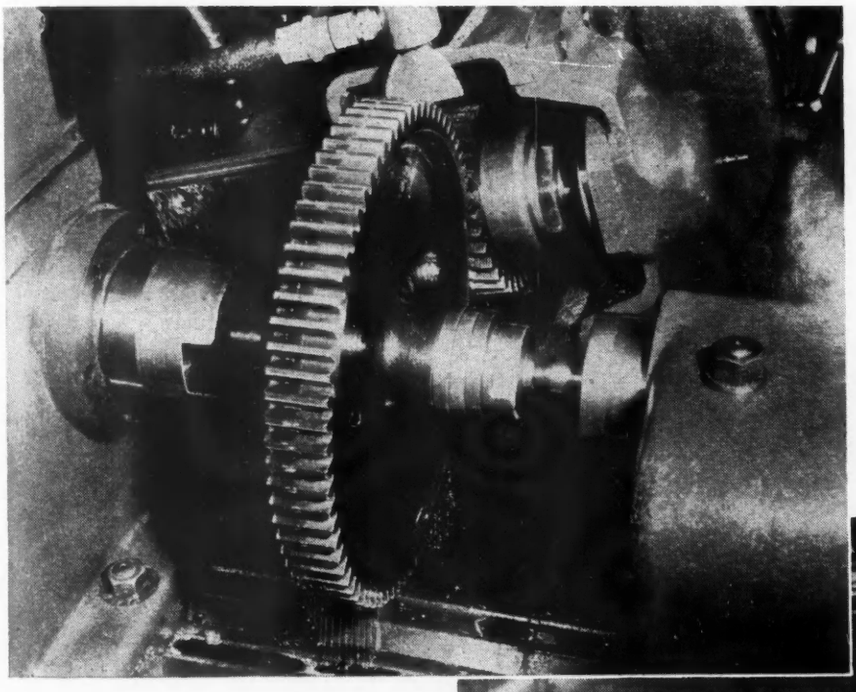
Production runs of gears at Wisconsin Axle are usually in quantities of 1000 or more of one type, although shorter runs (200 to 300) are made occasionally. Prior to the adoption of underpass shaving, Wisconsin practice had been to finish the green gears with shaper cutters, relying on lapping and running-in of the heat-treated gears to correct for machining and heat-treat errors, etc. Under this set-up considerable time was required to finish lap the gears. The addition of the shaving process has eliminated practically all lapping except for a "touch-up." Wherever possible, Underpass shaving is used to obtain the desired degree of accuracy and a reduction in production time.

Gear and pinion forgings are supplied to Wisconsin Axle Division from Timken-Detroit Axle Co. SAE 4820 is used for pinions, SAE 4620 for the gears. The former have a "green" hardness of around 200 Brinell. Gear forgings are held to around 160 Brinell (plus or minus about 5 points).

Pinion forgings go to Mahr annealing furnaces for normalizing, as a general practice to relieve forging strains.

Gear forgings go first to Warner & Swasey turret lathes for machining the faces, counterbores, ID and OD of the blanks. Blanchard surface grinders are used to green grind one face of the blank,

Gear Superintendent,
Wisconsin Axle Division, Timken-Detroit Axle Co.



(Above) Closeup of a Wisconsin spur gear being shaved on a Michigan 862 by the underpass method. Only pinions are curve-shaved at Wisconsin Axle. Higher precision, particularly towards the ends of gear teeth is reported for the underpass method.

(Right) Battery of three Michigan 862 gear finishing machines equipped for underpass shaving. A similar battery of machines is in another building. The two groups shave all of Wisconsin Axle Division's precision gear (80 per cent of total production).

A corner of the gear laboratory at Wisconsin Axle Division. Operator is checking a helical gear on a Michigan 1204 Sine-Line lead checker. The small indicator shown is used to check face for runout in the same setup. Another Michigan 1204 is at the left. Gears are spot-checked after every major gear cutting operation, to insure maintenance of precision and immediately locate sources of variations.

this face being used for indicating and locating in all subsequent machining and checking operations. Internal diameters then are ground on Heald internal grinders.

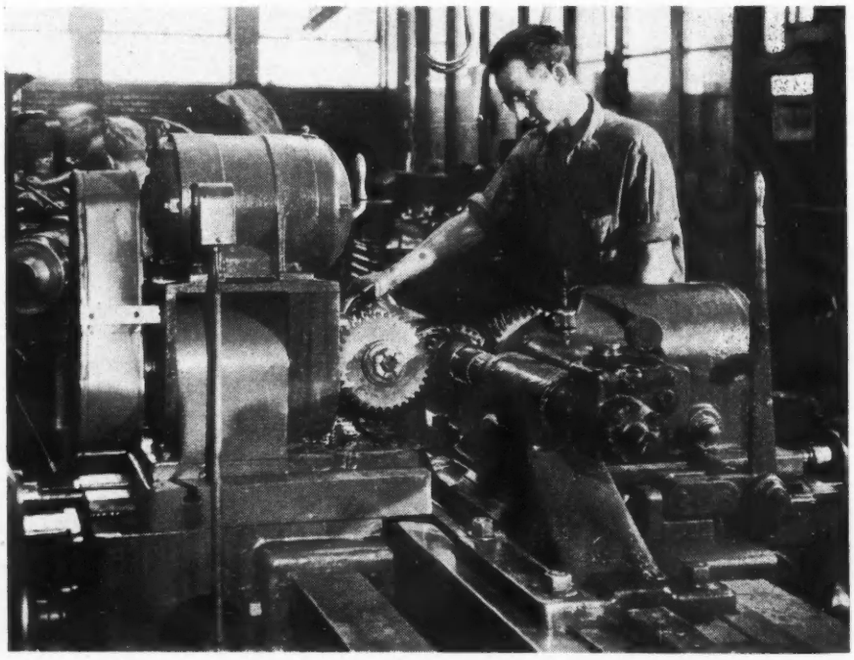
Dimensions of important surfaces as they come from these machining operations are held to within 0.002 in., while ground surfaces are held to a total allowable error of only one-half thousandth. One hundred per cent inspection as to runout of the blanks is provided at this point.

Pinion blanks are held to even closer limits for machined surfaces (0.001 in.), with the same tolerance as on the gears for ground surfaces. Pinion forgings are first milled to length on a Cincinnati Duplex milling machine. Both ends then are centered and the pinions go to Sundstrand stub lathes for machining the OD, bearing journal and shoulder. After inspection, bearing surfaces and shoulders are green ground on a Cincinnati and inspected 100 per cent for runout. The bearing surfaces on the pinion shaft are used for locating and reference in all subsequent machining operations.

Following runout inspection, both gear and pinion blanks have their teeth rough cut on either Barber-Colman or Gould & Eberhardt hobbing machines. For this operation, on gears to be shaved, Michigan Tool Co. pre-shave type hobs are used. Some gears—particularly shoulder types—are rough cut on Fellows gear shapers. In such operations Michigan pre-shave shaper cutters are used, if gears are to be shaved. These pre-shave hobs and cutters provide the desired clearance for the shaving cutters in the finishing operation. Gears and pinions as they come from the shapers have around 0.002 to 0.003 in. of stock on tooth thickness left for the shaving operation.

Michigan 862 type gear finishing machines are used for shaving. These are equipped to permit the use of underpass shaving, resulting in a reduction of roughly ⅓ in. finishing time. Another advantage found by Wisconsin for this method is the long tool life and as

(*Turn to page* 96, *please*)



Heat-treat errors are correct by lapping as on this Michigan 993 lapping machine. Lapping is merely a touch-up operation, however, due to the close control provided by the gear finishing machines.

High speed production of Automobile Generator Frames by

Automatic Metallic Arc Welding

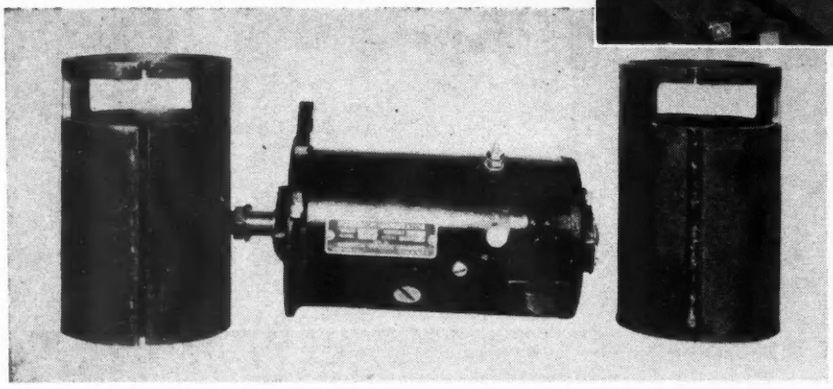


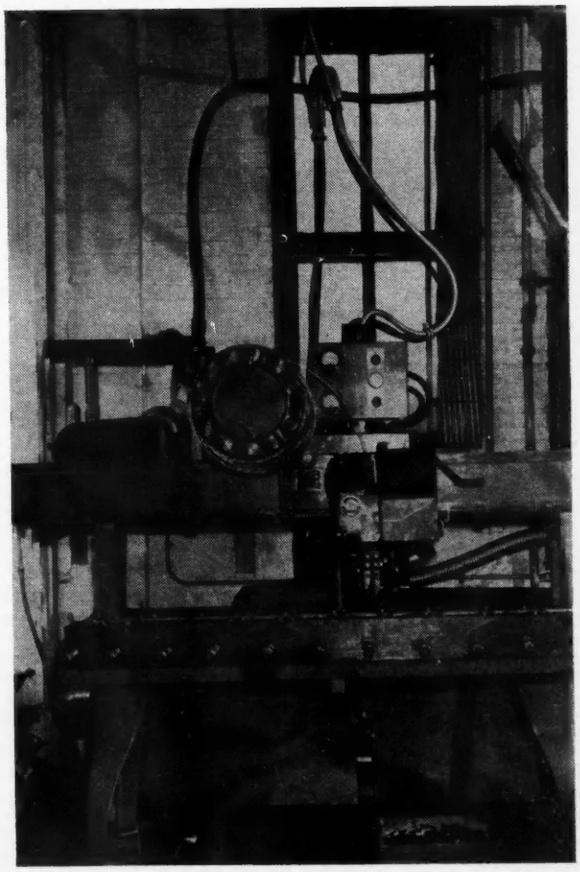
Fig. 1—(Left) Automobile generator frame prior to welding at the left. Frame after automatic welding is completed at the right. Between is a finished frame and generator assembly

Fig. 2—(Above) Closeup of frame holding and clamping fixture showing details of Lincolnweld automatic welding head

Fig. 3—(Below) General view of automatic metallic arc welding installation for mass-production of generator frames. Note vacuum flux recovery unit at upper right in the view below

By W. B. Horton

Welding Engineer, The Lincoln Electric Co.



RECENT developments in manufacturing tools that are geared to meet the tempo of industry's mass-production methods include Lincolnweld, the process of automatic metallic shielded arc welding. One current adaptation of the process to the manufacture of automobile generator frames is notable in that it typifies the application of Lincolnweld to the production of smaller type parts.

The work, as carried out at Superior Electric Co., Chicago, consists of fusing the 5/16 in. steel frames into a solid circular unit after they have been preformed as shown in Fig. 1.

In order to produce the frames at the current rate of 600 per eight-hour day, an arrangement was worked out whereby ten of the formed units were inserted end to end in a special jig or holding fixture with the seams facing up in close alignment. The seams of the frames are then closed to make a flush butt joint by tightening the bolts along the outside of the fixture with a wrench. A close-up of one of the frames as they are clamped before welding is shown in Fig. 2.

To start the automatic welding operation, the automatic welding unit consisting of the welding head, wire reel, flux hopper and control box, is moved to

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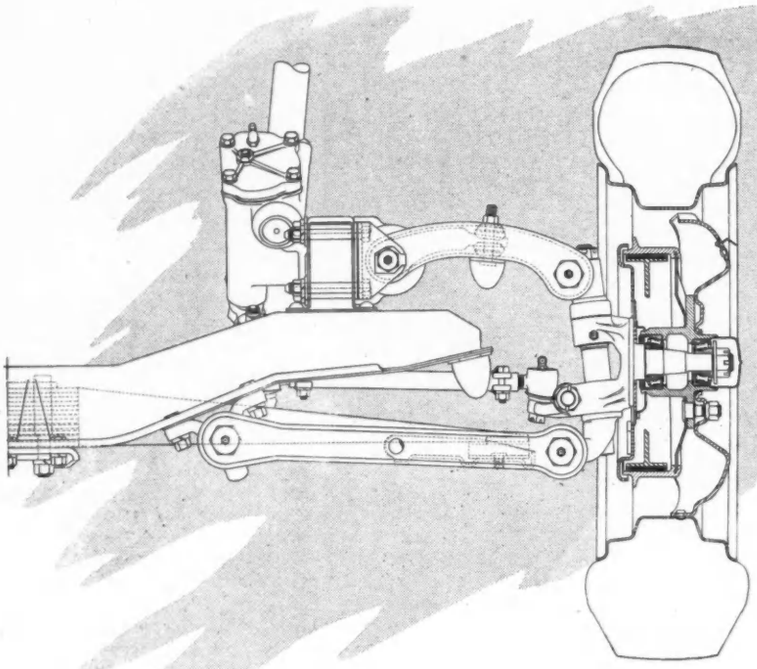
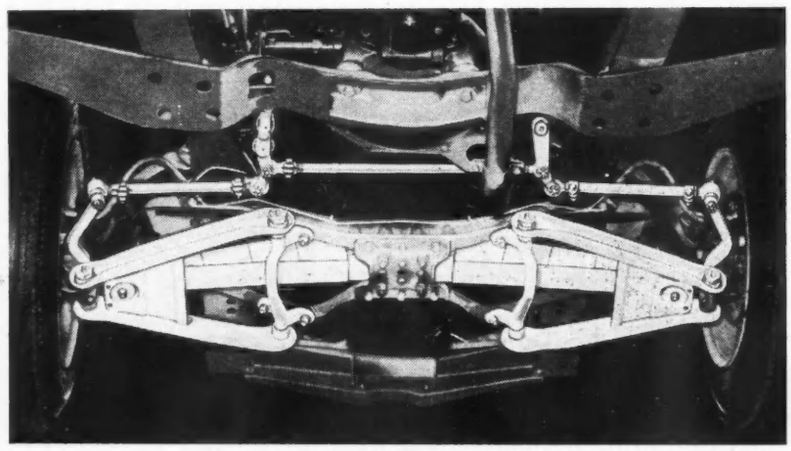
Mechanical Details of 1947

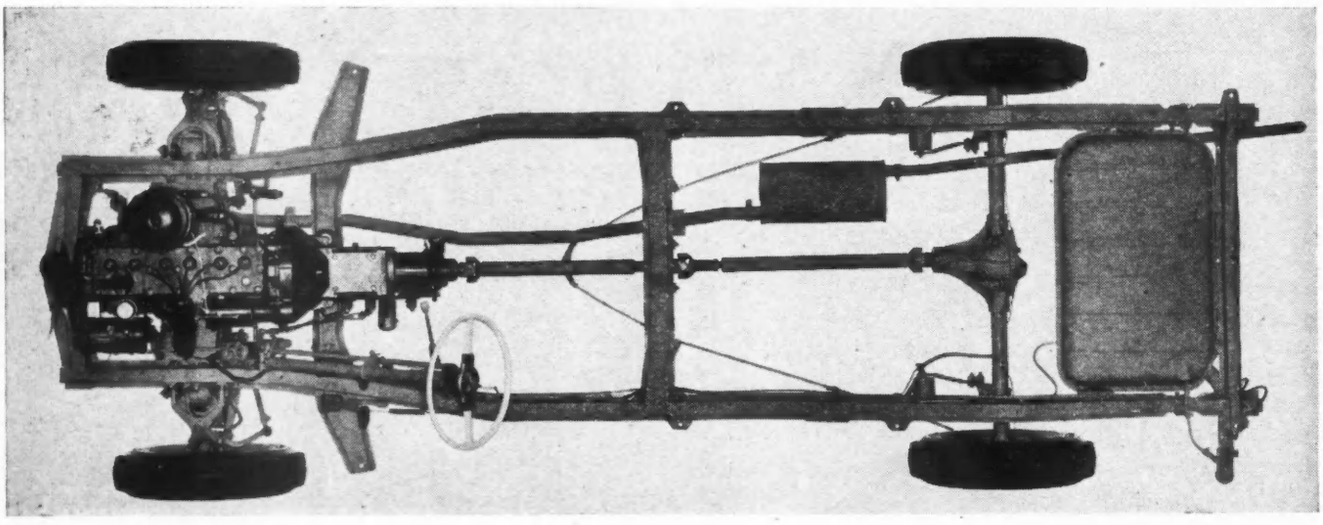


(Left) Line drawing of right unit Champion front suspension.



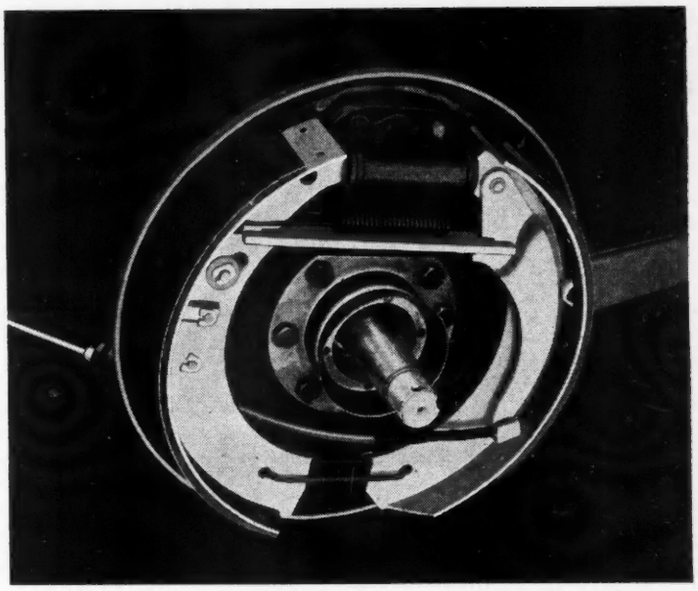
(Right) Underside view of the 1947 Champion planar suspension. The front of the chassis is at the bottom of the illustration.

(Below) Studebaker Champion chassis.

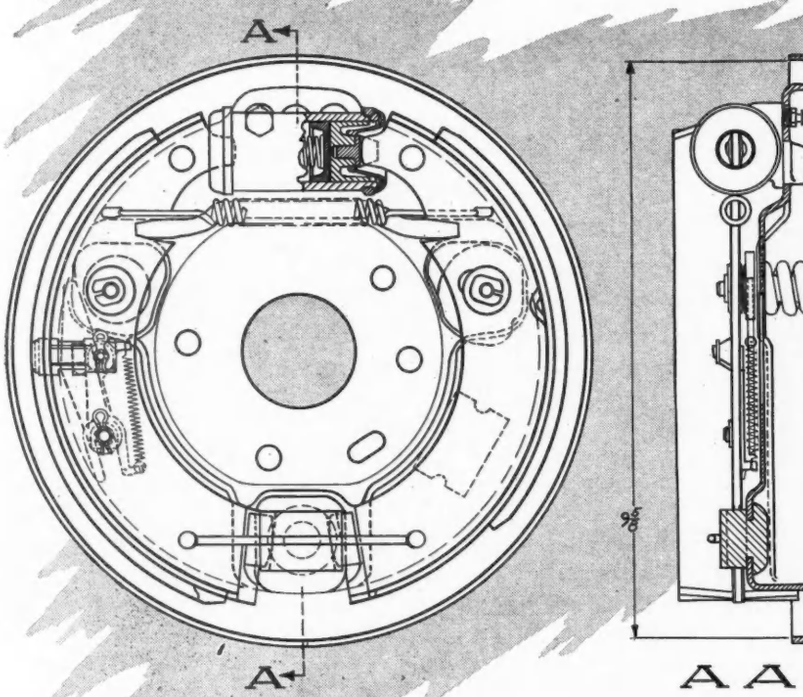


Studebaker

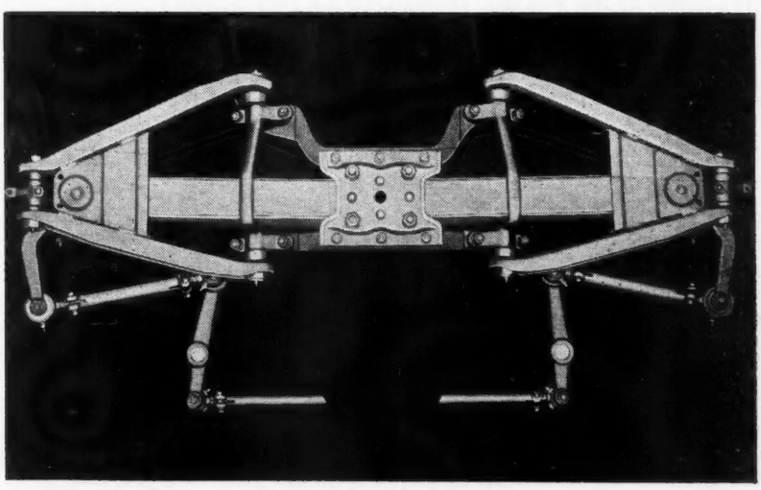
THESE illustrations give additional details of the engineering features incorporated in the 1947 Studebaker Champion and Commander models. Body styling and the earlier released details were published in AUTOMOTIVE AND AVIATION INDUSTRIES, May 1.



(Above) New rear brake showing its installed arrangement with the drum removed.

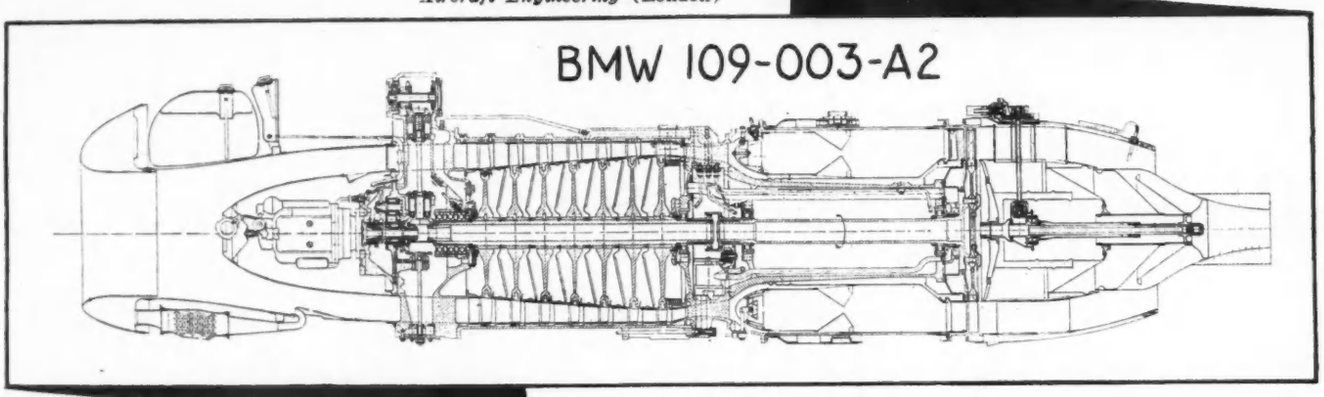


(Center) New front brake assembly furnished by Wagner Electric Corp.



(Right) Underside view of the front suspension used on the 1947 Commander model.

Sectional Views here reproduced by courtesy of *Aircraft Engineering* (London)



Performance Characteristics of

BMW 003 Turbojet *and Comparison with*

By W. G. Lundquist and R. W. Cole
Wright Aeronautical Corp.

IN ORDER not to duplicate previously published data, this article will omit practically all description of mechanical features of the machines under consideration, and will instead be confined to the performance characteristics of their principal components. It should be pointed out that the material presented here is not the result of experimental determination in this country, but is rather a resume of data obtained from German sources. The data included in this article were collected from the voluminous files of technical information obtained in Europe by Army and Navy technicians. As might be expected in an event such as that involved by the collapse of Germany, a great deal of conflicting information was accumulated as a natural result of having numerous investigators separately delving into the records of such a complex activity as that represented by the German aircraft power plant field. The authors make no pretense of having made a complete digest of data available, but they believe the following presents a fairly accurate statement of the actual performance obtained from the units under consideration.

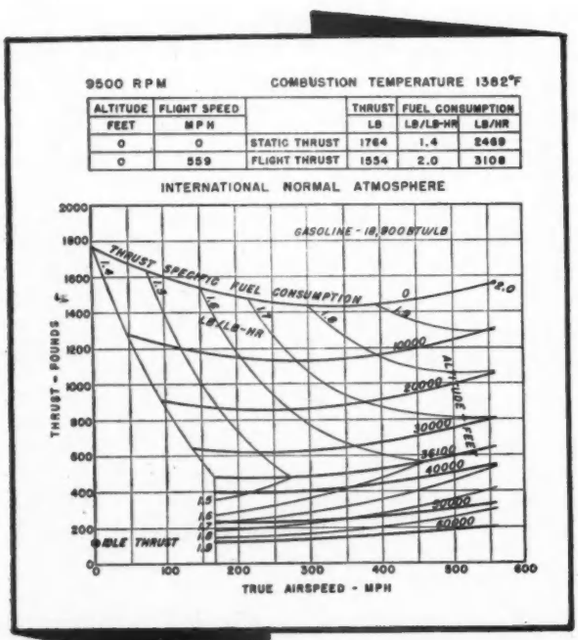
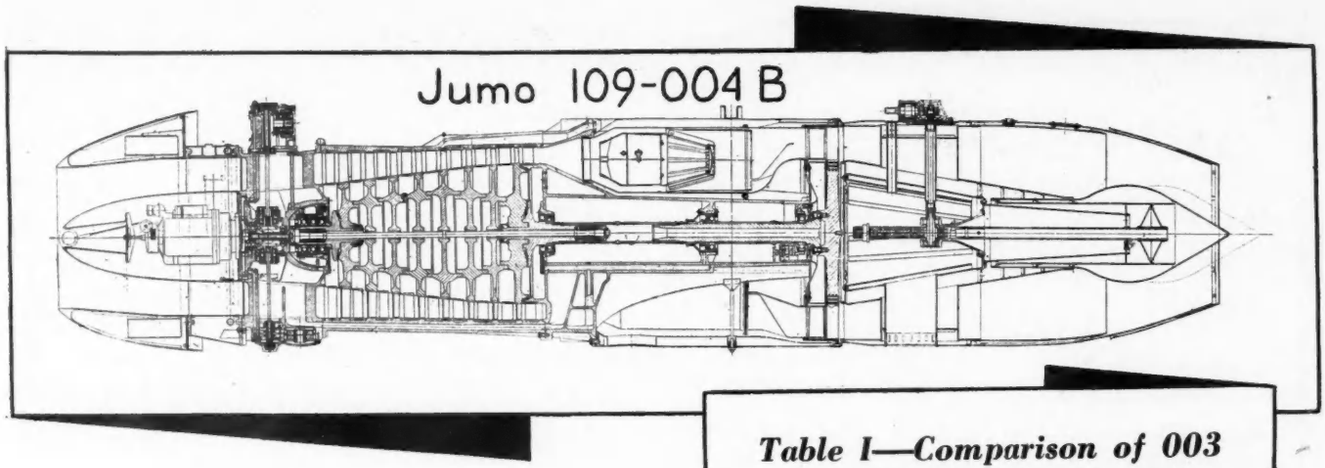


Fig. 1—Performance of BMW-003A turbojet.

The machine with which we are principally concerned in this discussion is the BMW 109-003 turbojet engine. This machine consists of a seven-stage axial flow compressor, an annular combustion chamber. a single-stage turbine, and a variable orifice jet. The compression ratio is approximately 3.1 to 1, and the operating temperature is approximately 1380 F. This machine was just going into large scale production during the latter stages of the war.

The Junkers Jumo 109-004B was the first German turbojet in active production. Since Junkers engines were supplying the demand quite well, production of the BMW 003A was delayed to permit further development. As a result, the BMW machine was more

This article is an excerpt from a paper presented at the recent SAE National Aeronautic Meeting in New York City by Mr. Cole, who is head of the thermodynamic analysis unit of the technical data division of Wright Aeronautical Corp. Mr. Lundquist is chief engineer of the company, and spent considerable time in Germany at the end of the war investigating the German aircraft power plant field.



Part one

Part two will appear in an early issue

Jumo 004

durable, although surprisingly little performance improvement is apparent. Table I compares the performance and significant design dimensions of the two types showing how closely they resemble one another. It is evident in this table that the Jumo 004 was a slightly larger machine, both physically and in the amount of thrust developed. However, the specific fuel consumptions were almost identical, as were the specific weights, the cycle temperature, and general component efficiencies. The only striking difference was the type of combustion chamber; the 004 had six individual chambers, while the 003 used a single annular design. On the basis of the performance and physical dimensions there is little choice between these machines, but the development of the 003 was directed toward ease of manufacturing, operating safety, durability, and high altitude burner performance, which factors do not appear in a tabulation of this type. In regard to these latter characteristics the 003 was reportedly superior and potentially it is believed it had a more promising future.

Fig. 1 shows the specification performance of the 003. These curves are drawn for maximum rpm and burner temperature on the assumption of an appropriately variable jet orifice and as such are quite conventional and self-explanatory. Note on this chart that a declining combustion efficiency was presumed above 36,100 ft altitude, causing the specific fuel consumption to become rapidly worse with increasing altitude. Had the

Table I—Comparison of 003 and 004 Production Turbojets

Model	BMW 109-003A-2	Jumo 109-004B-4
Static Thrust lb	1764	1984
Spec. Fuel Cons. lb/lb-hr	1.47	1.48
Turbine Speed, rpm	9500	8700
Weight lb	1345	1543
Specific Wt. lb/lb-thrust	0.76	0.78
Length, in.	143	163
Diameter, in.	27.2	28.7
Airflow, lb/sec	41.9	46.3
Comp. Tip Dia., in.	21.65	21.46 (Stage 1)
Comp. Dia. Ratio	0.725 to 1	0.645 to 1
No. Comp. Stages	7	8
Turbine Tip Dia., in.	24.70	27.48
Turbine Dia. Ratio	0.71 to 1	0.68 to 1
Burner Temperature, F.	1382	1390
No. of Burners	16	6
Combustion Chambers	1 annular	6 individual

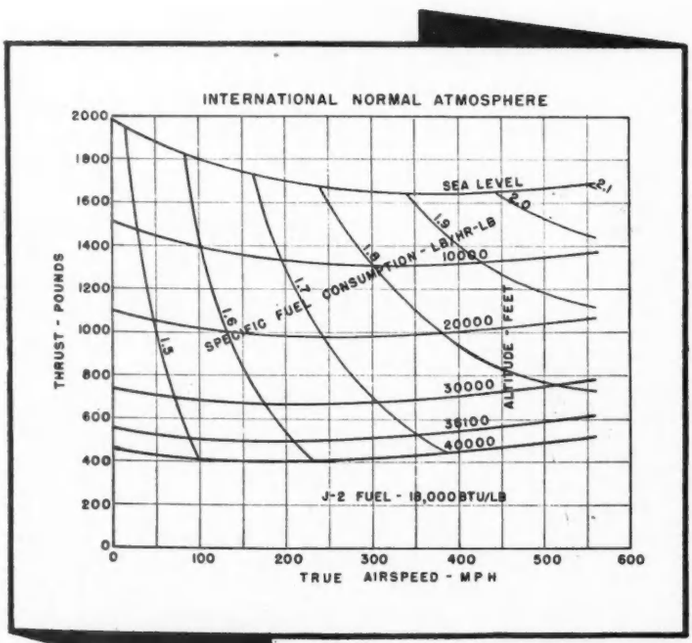


Fig. 2 — Performance of Jumo 004B turbojet at 8700 r.p.m.

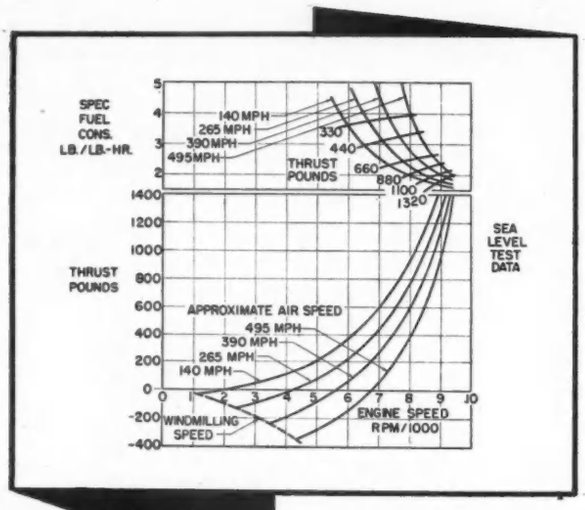


Fig. 3—Thrust and specific fuel consumption vs. engine speed of BMW-003A. Jet nozzle in high speed flight position.

same constant efficiency been used throughout, the lines of fuel specific in the isothermal region would have been vertical like the left hand boundary line at 1.4 lb per lb of thrust. The low fuel specifics compared to Table I are accounted for by the fact that the curve is based on the use of gasoline rather than J-2 fuel. It should be pointed out here that the Germans were forced by shortages of petroleum to use progressively poorer fuels in their jet engines. The first fuel, a good grade of gasoline, had a lower heat value of 18,900 Btu per lb, but later, the J-2 fuel, a light Diesel oil type with a heat value of 18,000 Btu per lb was substituted. Toward the end of the war tests were in progress to develop burners using crude petroleum, but this had not reached production status. Fig. 2 shows the performance of the Jumo 004 turbojet, with fuel consumption based on the use of J-2 fuel.

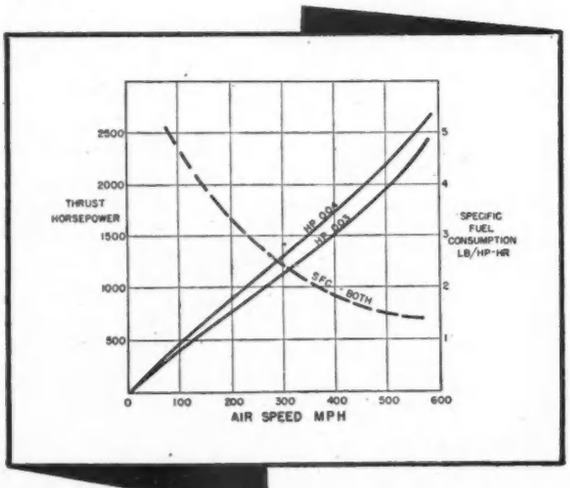


Fig. 4—Maximum power at sea level.

Referring to the preceding curves, while the performance indicated required a variable jet orifice, the production 003 had only four manually selected positions, these positions being starting and idling, climb, high speed at low altitude, and high speed at high altitude. Because this arrangement had caused considerable difficulty in combat, an automatic control had been designed and was being tested when production stopped. The 004 jet nozzle was positioned by a hydraulic control which was operated by a cam connected to the engine power control. The pilot selected an engine speed by adjusting a centrifugal governor which changed the fuel flow to obtain the required rpm. The jet nozzle position was a direct function of the throttle position, although there was an additional biasing control which made a minor adjustment for

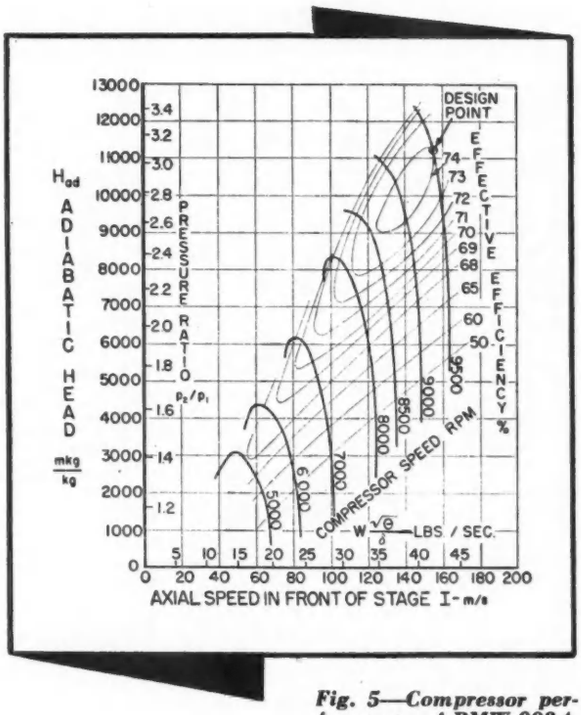

DESIGN POINT
EFFECTIVE EFFICIENCY %
PRESSURE RATIO p_2/p_1
ADIABATIC HEAD H_{ad} mkg/kg
COMPRESSOR SPEED RPM
$W\frac{\sqrt{\theta}}{\delta}$ LBS / SEC.
AXIAL SPEED IN FRONT OF STAGE I - m/s

Fig. 5—Compressor performance of BMW-003A.

air speed and altitude as indicated by pressure taps in the intake system. The variation of fuel consumption and thrust with rpm at several air speeds for the 003 is shown in Fig. 3. For the benefit of those who prefer to think of horsepower rather than thrust, Fig. 4 shows the thrust horsepower and power specific fuel consumption of both machines at sea level.

Compressor Performance

The compressor of the 003 is a seven-stage axial flow type employing NACA airfoil sections. The pressure ratio per stage is approximately 1.17 to 1 giving an overall ratio of 3.09 to 1 at the sea level static design point. Most of the German technical papers on the subject have stressed the difficulty of matching compressor stages and numerous tests of sections consisting of two or three stages were made to obtain

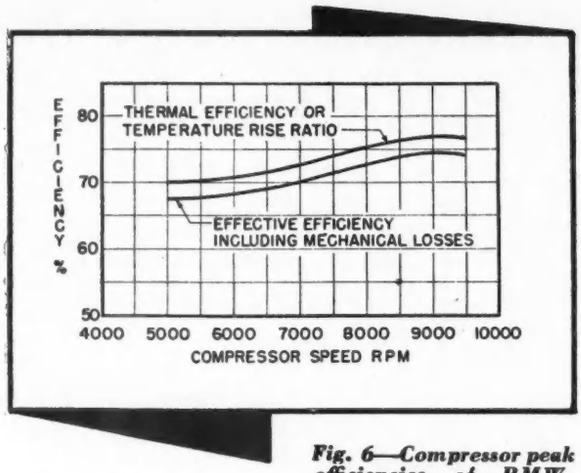


Fig. 6—Compressor peak efficiencies of BMW-003A.

the best matching of the components. The tests of the complete unit with interstage measurements however show that in spite of the extensive development, correct matching of the parts had not been achieved, and hence the overall efficiency curve is as shown in Fig. 5. This figure is a direct copy of a BMW test curve with the German method of presentation. The equivalent NACA scales are added for convenience in comparisons. The quantity "Adiabatic Head" is defined as the work required to compress isentropically one lb of air through the pressure ratio actually obtained. Thus it represents the isentropic enthalpy change between the initial and final pressures. The ratio of this adiabatic work and the actual work as measured by shaft power is the effective efficiency shown on the curve. At standard sea level initial temperature the Adiabatic Head, Adiabatic Temperature Rise ($Y\ T_1$)*, Ideal Work of Compression, and Pressure Ratio are mutually convertible, while the coordinate, Axial Speed before Stage I, is simply another volume flow term similar to $(Q/\sqrt{\theta})$** or $(W\sqrt{\theta}/\delta)$***. It should be emphasized that the efficiencies shown are based on shaft power measurements and therefore include mechanical losses. Fig. 6 shows the relative magnitude of efficiency calculated on this basis as compared to the conventional temperature rise ratio or thermal efficiency.

*— $Y = (r^{0.283} - 1)$ where r = compressor discharge pressure, in. Hg abs / compressor inlet pressure, in. Hg abs; T_1 = inlet temperature, F abs

**— $\frac{Q}{\sqrt{\theta}} = \frac{\text{air flow, cu ft/sec;}}{\left(\frac{T_1}{518.4}\right)^{1/2}}$

***— $W\sqrt{\theta}/\delta$ = same term expressed in weight flow

Essentials of Good Purchasing

By Robert Y. Matley

IT WAS Abraham Lincoln who said that, "God must love the poor people, because he made so many of them." By the same token, the purchasing agent should know his suppliers, because he has so much to do with them. Besides, they are not relatives but "friends" of his own choosing.

One of the first essentials of good purchasing is to build up dependable sources of supply. The purchasing agent might be called the "business articulator" for he searches the market and brings together in a working relationship, those businesses that must serve one another in order to complete the productive process. Just how close should be this organization of suppliers will depend on the nature and importance of the products they supply.

1. If it is an important raw material which forms the basis of the manufactured goods, the contact must be close and certain. Probably the source of supply will be owned outright or some inter-stock relationship effected.

2. Where the product is important and difficult to make to requirements, the sources may be leased or held under long term contracts.

3. If the goods are supplied by a large number of small producers no close relationship can be established.

4. If the product is a raw material produced over a wide area, it is apt to be sold through an organized market. Then purchases are frequently made on the market, although purchases from suppliers nearer home are often made.

In any event purchase contacts with salesmen, brokers, supplying officials must be had at more or less regular intervals. The way the purchasing agent conducts himself in the course of these contacts will determine the prices procured, good will established, and the future relationship between the business concerned. Much of it is personal contact and its importance cannot be over-stressed.

Establishing Sources

A purchasing agent may buy from one to thousands of items from as many suppliers. In our (normally) well-organized American market, this may seem an easy task, since there are available catalogs, trade directories, trade journals, salesmen, and generally a product suppliers file which gives a complete list of the suppliers dealing in any particular commodity. Conse-

(*Turn to page 92, please*)

Abstracts of Papers Presented at the

S. A. E.

Load-Carrying Capacity of Journal Bearings

by J. M. Stone and A. F. Underwood
Research Laboratories Div.
General Motors Corp.

THE load which a journal bearing will support is dependent on the minimum thickness of the oil film generated between the bearing surface and the journal. The thickness of this essential oil film is governed by a number of factors some of which are discussed in this paper. Numerous studies and tests have shown that journal bearing length, width, clearance, oil viscosity, and rpm all have important effects on the thickness of the oil film. As a result of this work, two rules for load-carrying capacity have been evolved and are generally believed. One, a bearing and journal combination, with zero journal speed, has zero load-carrying capacity; and two, a bearing and journal combination, with relative surface velocity, will always support a load.

In order to establish an equation for a general class of bearings, a formula was derived in a form of Reynold's equation. It applies to journal bearings in which the journal is rotating at a given speed, and a load is applied which is constant in magnitude but is rotating in either direction at a speed independent of the journal speed. The load carrying capacity of the bearing for different speeds of journal and load is given by:

Load-carrying capacity = K (2 load rpm — journal rpm) where it is understood the absolute value of the expression in the parentheses will be taken. The factor K for a given bearing depends on the length, diameter, clearance, minimum oil film thickness, and on the viscosity of the oil.

After the formula was developed, a test setup was constructed to demonstrate the validity of the conclusions. With this setup, it is possible to positively show the effect of load speed and journal speed.

In Fig. 1, the oil film thickness is shown with the load shaft at 1000 and 1800 rpm, but with zero journal speed. The decrease in minimum oil film thickness with an increase in speed is clearly demonstrated. This is caused by the fact that the load at 1000 rpm is 25 psi while it is 80 psi at 1800 rpm. The establishment of an oil film under these conditions of zero journal velocity, is proof that "Rule One" is not universally true.

In Fig. 2, the load speed is maintained at 1000 rpm and the journal speed is gradually increased from zero to 3000 rpm. As the journal speed is raised, the minimum oil film changes in two respects. At zero rpm, the film

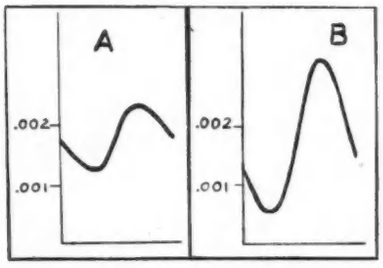


Fig. 1—Effect of increasing only load speed, which also increases load 3¾ times, while journal speed remains zero. A—load speed 1000 rpm, B—load speed 1800 rpm

is 0.0013 in. thick and has nearly a 90 deg lag behind the weight. By the time the journal speed is 2000 rpm, the oil film is zero in. thick and the phase angle has become zero. These records demonstrate the formula: LCC = K (2 load rpm — journal rpm). The formula says that, if the load speed is held constant at 1000 rpm and the journal speed is increased, the load-carrying capacity is decreased until it is zero at 2000 rpm. This is what happens in the bearing as shown in Fig. 2.

It should be especially noted that the critical speed of zero load capacity is reached when the journal is twice the load speed. This proportion was proven for all journal speeds. Rule Two is thus disproven, as here is a bearing with relative surface sliding but no load-carrying capacity.

When the journal speed is increased above 2000 rpm, the oil film is again established at a leading phase angle, as in Fig. 2. Reference to the formula will show that the load capacity increases as the speed is raised above the critical value.

Additionally important are the variations in ammeter readings as the journal is running at various speeds. The ammeter is rough measure of the friction in the bearing. Fig. 3 gives the ammeter readings. A peak occurs at the 2000 rpm critical speed because the journal is then running under boundary lubrication conditions. If there were no critical speed, the current would increase steadily from the rising oil viscosity torque. Above the critical speed, the ampere requirement is reduced when the oil film is reestablished. Previously, it was pointed out how the formula predicted no critical speed and an increase in load-carrying capacity when the journal turned in a direction opposite to that of the load shaft. The chart in Fig. 3 shows this in graphic form. As the speed is increased, a slight increase in oil film thickness is in evidence. Amperes increase steadily with no maximum because, with greater journal speed, the oil viscosity torque is higher.

What proof is there that no oil film thickness exists at the critical speed? The answer is found by the simple expedient of turning off the oil as shown in Fig. 4. With the oil turned off, only the load shaft revolves to produce a force on the oil film. That is to say, the journal speed is zero, with no relative sliding motion between the journal and bearing. The changes in the wave on

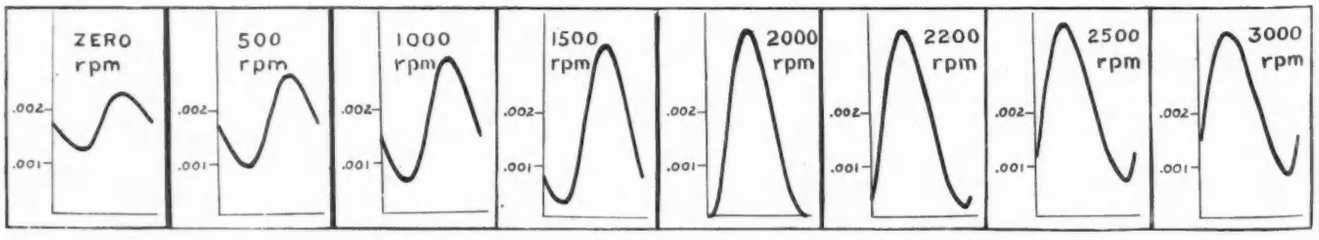


Fig. 2—Effect of increasing journal speed with constant load speed of 1000 rpm

Summer Meeting

A wide variety of problems in the automotive and aviation fields were discussed at the Summer Meeting of the Society of Automotive Engineers, June 2-7 at French Lick Springs Hotel, French Lick, Ind. Abstracts of various papers available from this meeting are presented herewith. Additional papers will appear in a future issue of AUTOMOTIVE ***and*** AVIATION INDUSTRIES.

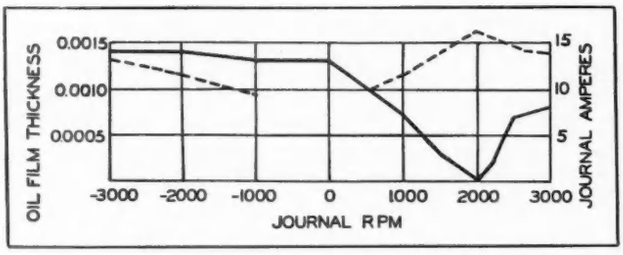


Fig. 3—Test data with constant load speed of 1000 rpm, load 25 psi, and radial clearance 0.00175 in.

Dotted line—Journal amperes.
Solid line—Oil film.

the oscillograph screen, go through the same sequence as when the journal was run from zero to the critical speed. When the oil is squeezed out, it cannot be replaced since the oil has been turned off. The oil film becomes thinner and the phase shift occurs. Finally, all the oil is squeezed out and the phase angle is zero. The load capacity is also zero.

With all the oil film gone, the oscillograph wave can then be calibrated. Under this condition, the journal is oscillating the entire clearance distance, and therefore, its amplitude is 0.0035 in. The oscillograph had a linear response in vertical deflection so the screen can be calibrated, as shown in the figures.

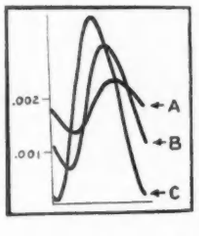


Fig. 4—Effect of oil supply in bearing with zero journal speed and 1000 rpm load shaft. Curve A—full oil supply. B—partial oil supply and C—No oil

Turning the oil on, quickly reestablishes the oil film. In fact, oscillograph records have shown that only one revolution of the load shaft is necessary before a thick film is formed.

These data clearly demonstrate the accuracy of the generalized formula. It is especially interesting to note that the formula applies to all widths of bearings, whereas many bearing formulas hold only for infinitely long bearings.

A Post War View of Alloy Steels

by Robert S. Archer
Climax Molybdenum Co.

A QUESTION which has often been discussed since the end of the war concerns the merits of the NE triple alloy steels in comparison with the old S.A.E. grades. The three alloying elements indicated by the term "triple alloy" are chromium, molybdenum and nickel. Substantially all of the molybdenum and nickel contained in scrap is recovered on re-melting by any process, and some of the chromium is recovered on re-melting, especially in the electric furnace process. Presumably, vanadium was not included in these steels because it was scarce and because of the fact that it is not recovered in tonnage melting processes. Chromium-molybdenum-nickel steels are not new, since these elements were used in combination with each other for many years before the war. Formerly, however, these three alloying elements were generally used together only when fairly high hardenability was required. The novelty about the NE triple alloy steels is that chromium, molybdenum and nickel are used in steels of moderate hardenability. The question is whether this practice is advantageous or otherwise in comparison with the use of a smaller number of alloy elements.

The advantage of the triple alloy steels was obvious when alloy conservation was a war necessity, in view of the impracticability of adequate scrap segregation. Conservation remains important in peacetime because of both the cost of alloy additions and the fact that supplies of alloying elements are not inexhaustible. The triple alloy steels are of immediate interest to the consumer because of the fact that all of the alloying elements are under positive control, which should be conducive to greater uniformity of behavior.

The importance of hardenability in the selection of steel is unquestioned, but it should not be assumed that hardenability is the only consideration of importance. It seems evident that carbon content and the general composition of the steel with respect to alloying elements also need to be specified if for no other reason than to permit the maintenance of fixed fabricating and heat treating operations. Furthermore, steels having almost identical Jominy curves in the hardened condition do not necessarily have the same mechanical properties when tempered to a given hardness.

The general formula for the selection of materials remains the same: the proper material is the one which gives satisfactory performance at the lowest ultimate cost. However, each of the factors in this formula is complex and requires re-evaluation in the light of

new technical information and economic changes. New levels of performance seem attainable as a result of greater knowledge of the conditions necessary for maximum combinations of strength and toughness in steel.

Analysis of a Shock-Excited Transient Vibration Associated with Combustion Roughness

by Arthur S. Fry, John Stone and Lloyd Withrow
Research Laboratories Div.
General Motors Corp.

THE experimental work is concerned particularly with the relationship between combustion pressures in the cylinders and shock-excited transient flywheel vibrations in an eight-in-line test engine and in a single-cylinder test engine. On the basis of these experimental data there has been developed a combined theoretical and mathematical analysis of the crankshaft-flywheel system. By means of this analysis, the relative intensities of the flywheel vibrations have been found when the combustion pressures were allowed to build up in various ways.

In general, the relationship between the intensity of the flywheel vibrations and the characteristics of the rise of combustion pressure is dependent on engine speed. For example, the intensity of lateral flywheel vibrations associated with combustion roughness diminishes with increasing rate of pressure rise when the engine speed is held in the vicinity of 3500 rpm. At this speed, the intensity of the flywheel vibrations increases sharply as the maximum combustion pressure is increased. At the same time, the acceleration and deceleration of the pressure rise exert no appreciable effect upon combustion roughness as judged by the intensity of the flywheel vibrations.

When the speed of the eight-in-line engine is reduced to 1000 rpm., however, the intensity of the flywheel vibrations increases rapidly with rising rates of pressure rise, until a value of 25 psi per crankshaft degree is reached. Increasing the rate of pressure rise above 25 psi per crankshaft degree does not markedly affect the intensity of the flywheel vibrations at 1000 rpm. The other three common characteristics of the pressure development are of less importance than rate of pressure rise, insofar as their effects on the flywheel vibrations are concerned. The order of their effectiveness is as follows: (1) Acceleration of the pressure rise, (2) magnitude of the maximum pressure, and (3) deceleration of the pressure rise.

These findings show that low rates and accelerations of pressure rise, which within certain limits are obtainable by proper combustion chamber design, will reduce combustion roughness at low engine speeds, insofar as it is related to lateral flywheel vibrations. But at high engine speeds, the maximum pressures must be lowered if these vibration intensities are to be diminished; for example, the spark advance must be retarded or the volumetric efficiency of the engine must be reduced. This result, plus the well known fact that small clearance volumes associated with high compression ratios impose serious limitations upon the combustion chamber designer, leads to this additional conclusion: More is to be gained in the solution of the roughness problem by altering the mechanics of the vibrating system than by controlling combustion chamber shapes.

Piston Lubrication Phenomena in a Motored Glass Cylinder Engine

by S. J. Beaubien and A. G. Cattaneo
Shell Development Co.

THE object of the work presented was to gain some insight into the movement of the oil in the ring belt during engine operation, and into the action and the movement of the piston rings by which the oil movement is largely determined. For this purpose an engine was built with a glass cylinder which permitted visual observation of oil, piston and rings by stroboscopic and photographic means. For several reasons, the work was carried out by motoring this engine without combustion. The main reasons lay in the much simpler instrumentation, in avoiding the need for cooling the cylinder and in the possibility of introducing a measuring device through the combustion chamber. Thus only the effects of mechanical forces, and not the effects of the heat and pressure of combustion, have been studied. It may be mentioned in passing that since completion of the work on the motored engine, operation with combustion has now been made practical by introducing an appropriate cooling method.

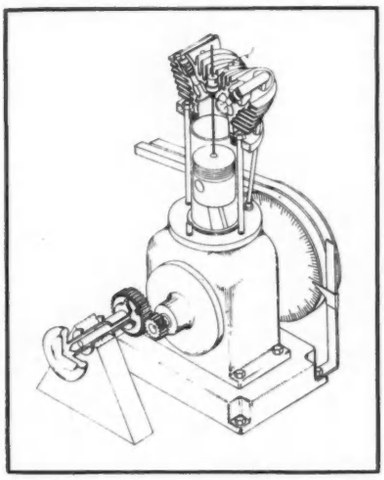


Fig. 5—Drawing of the glass cylinder engine, designed for observation of cylinder lubrication problems

A drawing of the engine used is shown in Fig. 5. Bore and stroke are 2⅝ in. and 3¼ in., and maximum speed 2000 rpm. The Pyrex glass cylinder is nominally ¼ in. thick and precision bored to a tolerance of ±0.002 in. Piston clearances were made relatively large to exaggerate the oil flow patterns and facilitate observations: skirt clearance 0.015 in., ring side clearance 0.004 in., ring gaps approximately 0.090 in. The connecting rod is 8.856 in. long, i.e., longer than usual for a 3¼ in. stroke, to minimize side thrust. Compression ratio is 2½. An SAE 30 lubricant at room temperature was used for the conventional splash lubrication. During motored operation the intake air was passed through an ice tower. Thus engine temperatures did not rise appreciably above room temperature.

The gears in the lower left corner are part of a phase changing mechanism by which a stroboscopic light is timed to flash at any desired point of the piston's stroke. Continuous visual observation of the piston is possible in this way while the engine is operating at full speed. For photographic purposes this stroboscopic light with its timing mechanism was used to trip a single flash Kodatron lamp.

As an initial step the position of the top ring in its groove was determined by an electrical circuit which includes the rod emerging from the center of the piston and extending through a gland in the cylinder head. When the ring is on its lower seat, the stroboscope tripping circuit is completed through an outside sliding contact to the rod at the center of the piston, through the connecting wire to the ring, and so to the piston and engine frame. When the ring is on its upper seat, it touches only the glass cylinder wall and the top land made of electrically nonconducting material. Consequently, the stroboscope tripping circuit is open and the light does not flash.

The gas pressure above the rings can be theoretically computed or actually measured in an engine but this force is an undesirable variable to work with because of variation during the cycle and its discontinuity due to valve action and column-mass forces from the manifolding. To eliminate this variable, the engine head was replaced by a tank with a volume of approximately 100 times the piston displacement. The remaining 1 per cent pressure variation due to the piston movement can be neglected.

A Visual Study of Cylinder Lubrication

by Milton C. Shaw
and Theodore J. Nussdorfer
Aircraft Engine Research Laboratory, NACA

A VISUAL study of the cylinder-lubrication process was conducted at the Cleveland laboratory of the NACA with a specially designed engine equipped with a glass sleeve (see Fig. 6). The orientation of the piston and the extent and characteristics of the lubri-

cating film were examined with the test engine motored over a limited range of operating variables. A description of the apparatus and the test techniques with some test results were presented in this paper.

The oil film between a piston and a cylinder is generally invisible when directly illuminated. A relatively thick oil film, such as is obtained in a journal bearing under light load, may be rendered visible by means of a substance added to the oil. In lubrication studies with glass journal bearings, Barnard used a dye and Vogelpohl used graphite and sawdust. Because the oil films encountered in cylinder lubrication even under light loads are extremely thin, a concentration of dye or other material sufficient to make the extent of the film visible would be difficult, if not impossible, to obtain. Two new methods of making very thin oil films readily visible were used in this investigation.

One method of rendering oil films visible utilizes a scattered-light technique. The relative positions of the lights, baffles, and camera required by this technique are diagrammatically shown in fig. 7. The energy from a capacitance of 8 mf at 2000 v was dissipated through a pair of General Electric flash tubes (FT-19 type) stroboscopically. The flash tube circuit was triggered by a set of automotive breaker points operated by a cam on the crankshaft.

Light enters the space between the piston and the cylinder wall at a grazing angle when this space is completely filled with oil. The fluorescent dye in the oil increases the intensity of the light to be scattered. Some of the scattered light leaves the cylinder, resulting in a sensation of light at all points where there is an oil film and one of darkness where no oil film exists. This phenomenon of light scattering is the basis of the ultra-microscope devised by Siedentopf and Zsizmondy in 1903. Satisfactory photographs were obtained from a single flash of two lamps using highspeed panchromatic film and a camera having an f/1.9 lens.

In the fluorescent-light method the glass cylinder is directly illuminated by long-wave-length ultraviolet radiation from which all the visible light has been filtered, a so-called beam of "black light." Inasmuch as all motor oils are fluorescent, a visible light will be emitted from the oil film and only invisible ultraviolet rays are reflected from points at which there is no oil film. The intensity of the visible fluorescent light varies with film thickness and concentration of the fluorescent dye in the oil.

The fluorescent-light method rendered an oil film very distinct to the eye, but the intensity of the fluorescent light was insufficient for a photograph to be obtained with a single stroboscopic flash of light. Good multiflash photographs were obtained by using a brilliant stroboscopic source of ultraviolet light and a camera with a fast lens. General Electric FT-19 flash tubes in conjunction with Hanovia SC 5022 filters were the most satisfactory stroboscopic light source. Photographs were obtained with 25 flashes from two tubes using a camera equipped with an f/1.9 lens, a Wratten No. 2A filter, and a fast panchromatic film. The filter was used to prevent reflected ultraviolet light from entering the camera lens—an important consideration because of the extreme sensitivity of photographic film to ultraviolet rays of long wave length.

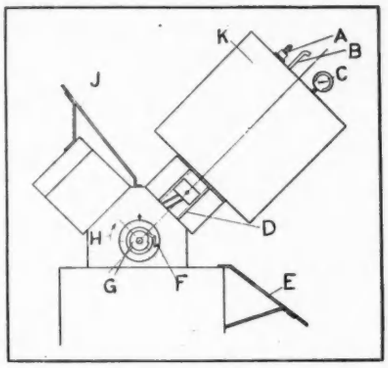


Fig. 6—Diagram of engine equipped with glass cylinder

A—Pressure relief valve
B—Nitrogen inlet
C—Pressure gage
D—Glass cylinder
E—Camera bracket
F—Breaker points
G—Crankshaft cam
H—Rotation
J—Camera bracket
K—Pressure chamber

This study of cylinder lubrication, made by direct observation of the oil film in tests with a glass-cylinder engine, yielded the following results:

1. In accordance with hydrodynamic theory, the piston was inclined in such a direction as to favor an oil wedge on the loaded side of the cylinder during the greater portion of the engine cycle.

2. The piston moved laterally from the major-thrust to the minor-thrust face of the cylinder under the influence of piston side thrust.

3. The amount of lubricant present on the piston skirt varied with the relative angular position of the piston rings and with cylinder pressure.

4. Rate and direction of piston-ring rotation varied with cylinder-head pressure and engine speed. Rates of rotation as high as one rpm at an engine speed of 1000 rpm were observed.

5. The approximate thickness of an oil film on the piston-ring face, when operating under load, was 0.0001 in. or less.

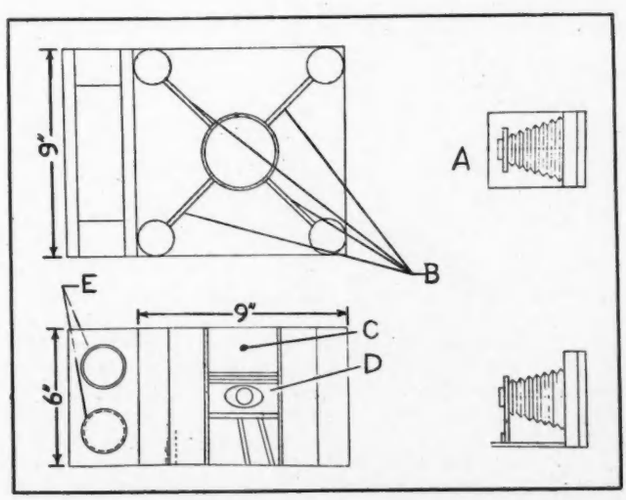


Fig. 7—Arrangement of apparatus for photographing cylinder lubrication by scattered-light method

A—Camera
B—Baffles
C—Glass cylinder
D—Piston
E—Flash tubes

Aluminum Brazing Development

by L. P. Saunders and P. S. Rogers
Harrison Radiator Div.
General Motors Corp.

RECOGNIZING the fact that the brazing alloy and parent metal are alloys of aluminum, and having had experience on brazing cupro-nickel with copper wherein the brazing alloy also would "soak" into the parent metal, the problem was to find the correct temperature and time for aluminum brazing. Too high a temperature would produce holes in the structure due to the filler material alloying with the parent metal. If the temperature was not high enough, the brazing alloy would not flow. This alloying effect of the brazing material and the parent metal is a function of both time and temperature. A complete series of tests were run with the best results obtained at 1180 F at 25 minutes' time in the furnace. These results were not entirely satisfactory, for it was found that small pieces brazed much better than larger ones. This indicated that the furnace-piece size ratio should be changed.

A gas-fired solder bake oven was then rebuilt with a number six American Blower fan installed in the rear door to provide air for forced convection heating. Heat baffles were installed to minimize radiation of the heating elements. This reduced the time of the piece in the furnace from 25 minutes to 10 minutes and produced better brazing.

The samples were well bonded, but there was a large number of holes in the tubes which called for an extensive

program on cleaning procedures. It was ultimately found that small particles of copper, lead, or brass would produce holes due to their alloying effects with aluminum, and that the best results were obtained where the aluminum was also free from grease or oil. A simple chemically clean test was the showing of a non-water break surface. Furnace temperatures were raised and lowered and the time was varied, until finally a temperature of 1130 F and a time of six minutes gave a unit that showed good brazing and no run-throughs on one half of the assembly. Uniform results were finally obtained by thoroughly drying the units after applying the flux.

The flux is received as a powder, is mixed with water to suit the application and applied before or after assembly of the parts. For thin metal it was found that the layer of flux between the joints applied before assembly, did not give as good brazing as maintaining a metal to metal contact and applying the flux after assembly.

Previous experience in furnace brazing indicated the best fixture design was the simplest, and the optimum condition was one in which the product was self-supporting, requiring only a flat plate for a tray and perhaps a flat plate on top of the work to allow the force of gravity to hold the parts in proper alignment. Various types of metal were tried for the plates, but only ordinary cold rolled steel proved satisfactory when used with a thin sheet of asbestos between the plate and the work.

With respect to physical and mechanical strength, the aluminum radiators have been approved by the Army after having successfully passed the ANC-75 test procedure. A soldered copper constructed supercharger intercooler, which was satisfactory in the field, was placed on the vibrating machine and the frequency and the amplitude increased to the point where it fell apart in 27 minutes. The aluminum construction under similar conditions ran in excess of 50 hours.

Automotive Glazing With Plastics

by George B. Watkins, Director of Research and Joseph D. Ryan, Asst. Director of Research, Libbey-Owens-Ford Glass Co.

BECAUSE of the lower density of plastics, compared to that of safety glass, and ease of fabrication into curved sections, consideration is being given to their application for glazing post-war cars.

To determine or establish the suitability of plastics for motor car glazings, a study, including laboratory tests and practical glazing tests, has been made of three commercially available plastics; namely, the polymethyl methacrylate plastics, Lucite and Plexiglas, and CR-39. For evaluation purposes in the laboratory these three plastics were subjected to the qualifying tests as established by the American Standards Association in their Safety Glass Code Z 26.1. Service tests were made by glazing three 1941 model sedans, except for the rear window, with the three plastics.

As a result of these studies, a number of general conclusions were reached. First plastic glazings are extremely difficult to clean, because the road scum does not wash off as readily as from glass surfaces. Polishing and cleaning agents used on glass, such as rouge and Bon Ami, instantly scratch all three plastics. Water did not wet the plastic windshields to the same extent as it did glass, tending to stand up in droplets which the windshield wiper did not readily remove. In body lights, vision was also markedly hampered by these water droplets which do not run off like they do from glass glazings. This was observed to a greater extent with Plexiglas and Lucite than with CR-39 which seems to be wet by water more readily. In general, it was observed that the CR-39 glazings cleaned more readily during service. During wiping to dryness, annoying static developed on the plastic surfaces, picking up dust.

The life of Plexiglas or Lucite in the windshield under average conditions using the wiper occasionally, ranges from 30 to 45 days. Beyond the 30-day period, driving with the abraded windshield became dangerous because of distortion of vision. The life of CR-39 windshields subjected to occasional windshield wiper action was 60 to 180 days. Safety plate glass windshields, from the standpoint of vision, are far superior after three to four years' service to any of the three plastics after a few weeks' service. All CR-39, Plexiglas and Lucite body lights, after 12 months of service, show numerous scratches varying from hair line to deep scratches. These were not so annoying at the end of one year's service that an impartial observer would feel their replacement was imperative.

Plexiglas, Lucite and CR-39 are considerably more resistant to impact than ordinary sheet or plate glass and to that extent are safer when used for automobile glazings. When ruptured, however, sharp, dagger-like particles, similar to ordinary glass, are produced. In this respect, CR-39 is worse than Plexiglas or Lucite, since for any given impact more fragments are formed. In order for the plastics to meet the A.S.A. Code impact tests for laminated Safety Glass, a minimum thickness slightly greater than ¼ in. is indicated for CR-39 and 7/32 in. for Plexiglas or Lucite.

Plastic glazings do not present a serious fire hazard, but certainly afford less protection than glass glazings from this standpoint.

Plexiglas and Lucite are equally as stable to sunlight as CR-39 in spite of the fact that CR-39 passed the A.S.A. Code test, while Plexiglas and Lucite failed. While CR-39 is stable to the extremely intense radiation of the Uviarc required in the Code test, all three plastics are of comparable stability when exposed to a less intense source of radiation.

Potentialities of the New Fuels in the Design of Passenger Car Engines

by Earl Bartholomew
Ethyl Corp.

ON AN indicated basis, power output at any particular compression ratio is substantially proportional to charge density in the manifold and specific fuel consumption is practically constant. Thus it would appear that supercharging offers a means of utilization of improved fuel antiknock value for the production of a large amount of power from a relatively small displacement but without improvement in fuel economy. Although engine friction was not affected significantly by compression ratio in the previous examples, both engine friction and pumping losses were shown to have a considerable effect on the possible gain in

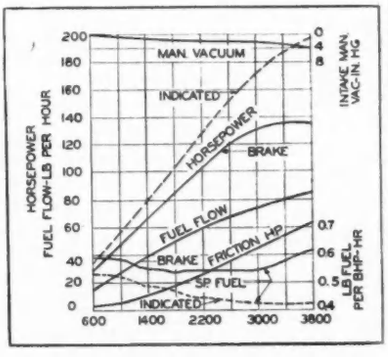


Fig. 8—Full throttle test data for an unsupercharged, L-head automotive engine

economy from increase in compression ratio. They are also important factors in the determination of the fuel economy of a supercharged engine installed in an automobile. An example will serve to illustrate the effect.

Fig. 8 shows power, friction, fuel consumption and manifold pressure observed on an L-head passenger car engine. Hp and specific fuel consumption are also shown on an indicated basis.

Experience has shown that there is no significant increase in friction due to supercharging and, as stated previously, that ihp is substantially proportional to absolute manifold pressure at constant temperature.

The ihp for the engine of Fig. 8, at a manifold pressure of 10 in. Hg above atmospheric, is calculated on this basis in Fig. 9. If bhp is defined as the power available from an engine with connected blower,

ihp = bhp + Friction with Natural Aspiration + (Total Blower Power - Delivery Power)

The curve of bhp in Fig. 9 is derive

from the above equation. A blower efficiency of 57 per cent is assumed relative to adiabatic compression followed by constant pressure delivery. Tests of a positive displacement blower indicated this as an average efficiency over the range of flow required by the engine under consideration.

The engine of Fig. 8 was supercharged to 10 in. Hg over the speed range by air delivered from an external source. Thus the engine was not required to furnish power for compression and was the beneficiary of the delivery work of the charge at the manifold pressure. Therefore,

Measured hp = bhp (as defined above) + Blower Compression Power + Blower Delivery Power

The curve of observed bhp in Fig. 9 is obtained from the above equation. The same blower efficiency of 57 per cent is assumed.

Fuel flow is calculated from the flow with natural aspiration on the assumption that it is proportional to the absolute manifold pressure. Calculated brake specific fuel consumption is this flow divided by the calculated bhp. The observed brake specific fuel consumption is the measured fuel flow divided by the observed bhp as plotted.

It will be noted that there is reasonably good agreement between the measured and calculated power and economy, reaffirming the soundness of the assumption on which the calculations are based. On the average the brake specific fuel consumption for the supercharged engine, at a given speed and mixture ratio, is substantially the same as that of the naturally-aspirated engine at full throttle. This relationship has been found to hold for different types of automobile engines over a substantial range of boost. This particular engine, tested with an engine-driven, positive-displacement type blower, gave similar results, however, the boost was not constant over the speed range.

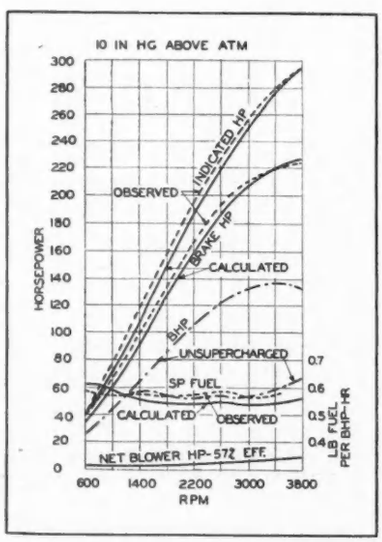


Fig. 9—Calculated and observed performance of the engine in Fig. 1, supercharged and operating at a mainfold pressure of 10 in. Hg above atmospheric pressure

A small supercharged automobile engine, having substantially constant specific brake fuel consumption, over the range of manifold pressure above atmospheric, appears to offer interesting possibilities from the standpoint of fuel economy. Such an engine has not yet been tested in a car by the Ethyl Laboratories, however, calculations of expected fuel economy have been made in accordance with the above-stated assumptions.

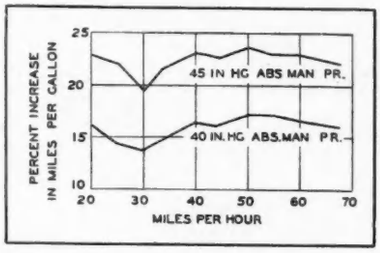


Fig. 10—Calculated increase in gasoline mileage of a small supercharged engine over the conventional unsupercharged engine of Fig. 1

On the basis of experimental results, it is believed that the small boosted engine could be operated at an absolute manifold pressure of at least 40 in. Hg, possibly 45 in., at 6.1 compression ratio and maximum power spark advance on fuels having a road octane number of 95. The calculations indicate that, on the basis of 40 in. or 45 in. manifold pressure, the displacement could be reduced to about 74 per cent or 66 per cent respectively of that of a naturally-aspirated engine having the same compression ratio if the previously assumed 4.4 rear axle is retained.

Fig. 10 shows a calculated increase of approximately 16 per cent in miles per gallon for the small engine boosted to 40 in. Hg abs, relative to the larger naturally-aspirated engine having the same compression ratio. For the still smaller engine, boosted to 45 in. Hg abs, the calculated increase in fuel economy is about 23 per cent. It is interesting to note that, at constant level road speeds up to 70 mph, both of the smaller engines would operate at manifold pressures below atmospheric.

Thus it is apparent that, in conjunction with fuels of improved antiknock quality, either higher compression or increase in manifold pressure may be employed to provide either a substantial increase in vehicle performance or fuel economy, or a smaller simultaneous increase in both.

The Performance of European Economy Cars

by Laurence Pomeroy
Technical Editor of "The Motor," London

IN 1939 a great deal of work was being done in Europe on the genuinely streamline car. As a result of wind tunnel tests followed by construction of full scale prototypes, it was established that the drag could readily be halved, in fact reduction in wind resistance by two-thirds was by no means impossible. A reduction in drag is important on small cars and shows that aerodynamic form is of greater significance on the European type of car than on the U. S. type with higher initial performance. For example, a drag reduction of 50 per cent is equivalent to a theoretical gain in maximum speed of 26 per cent. The average speed for the European car increases from 63 mph to 80 mph, while in the more highly developed type of small car the maximum increases from 70 mph to 88 mph.

Some of the more highly developed European cars incorporating aerodynamic form are presented here as specific examples. These admittedly take the form of experimental models but they are straws which show which way the wind is blowing.

The Adler car is powered by a four-cylinder L head engine with a bore of 2.92 in., a stroke of 3.74 in. and a 103 cu in. capacity. In competition form this engine develops 55 bhp, and on this power the car will exceed 100 mph. One of the more remarkable feats achieved, was traversing "2400" miles in 24 hours on the German autobahn Frankfurt, other traffic using the road concurrently. The car has a front wheel drive and the body work is constructed entirely from light alloy. Total weight is 1850 lb, and gearing is 24 mph at 100 rpm.

The Mathis car (see April 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES) has a wheelbase of 90 in., front track of 59 in. and a height of 58 in. There is a one-piece body and chassis construction in light alloy which constitutes 40 per cent by weight of the curb weight of 1000 lb. Power unit is a liquid cooled, opposed twin cylinder with a bore of 2.95 in. and a stroke of 3.16 in., giving a capacity of 42.5 cu in. This develops 15 bhp at 3000 rpm, and in a normal car would provide a top speed of barely 50 mph. The Mathis is a three-wheeler and the drag is only 30 per cent of that of a normal car, thus boosting the top speed to about 70 mph. Fuel consumption is claimed to be 79 miles per gallon (U. S.) on cross-country running at 41 mph average, and 94 m.p.g. at a steady 44 mph.

A two-seater Fiat was developed primarily for competition work and has a tail longer than advisable for normal use. The wheelbase is 95 in., track 48 in. and curb weight 1825 lb. The overhead valve, four-cylinder engine has a bore of 2.64 in., a stroke of 2.95 in., a capacity of 645 cu in. and develops 42 bhp. It is geared 21 mph at 1000 rpm, and the car has a maximum speed of 90 mph. Fuel consumption is given as 40.6 miles per gallon at 30 mph, 34 miles per gallon at 60 mph and 25.6 miles per gallon at 80 mph. The body work is of light alloy con-

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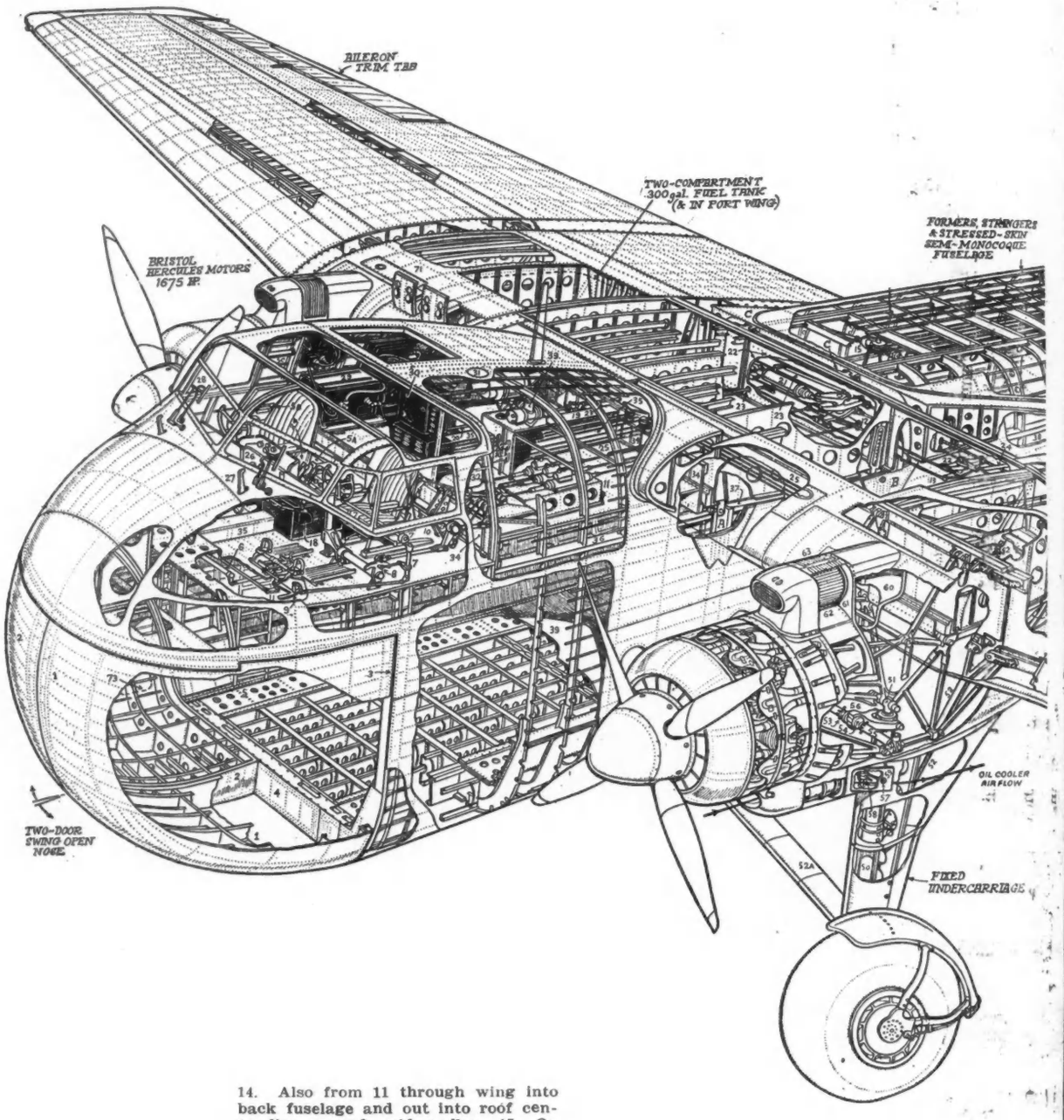
Bristol 170 Freighter


AILERON TRIM TAB
TWO-COMPARTMENT 300 gal. FUEL TANK (& IN PORT WING)
FORMERS, STRINGERS & STRESSED-SKIN SEMI-MONOCOQUE FUSELAGE
BRISTOL HERCULES MOTORS 1675 H.P.
OIL COOLER AIR FLOW
TWO-DOOR SWING OPEN NOSE
FIXED UNDERCARRIAGE

1—Port door
2—Starboard door
3—Door-hinge line
4—End of fuselage floor
5—Ladder up to cockpit (out through hatch at 5A), handgrip in hatch cover 5B and at 5C
6—Rudder and elevator under floor couplers

Rudder, Elevator and Aileron Locks and Control Runs

Swing out the arm 7 and pin it to aileron wheel. Swinging 7 shoots plungers into elevator lever 8 and into rudder lever 9 to lock them.
10—Rudder, elevator and aileron linkage between pilots and assister units 11
11—Auto-pilot equipment and stowage, with cables onward through wing box to bell-crank 12 and out 13 to aileron 14. Also from 11 through wing into back fuselage and out into roof centre-line around guide-pulleys 15. On to rudder arm 16 and elevator 17

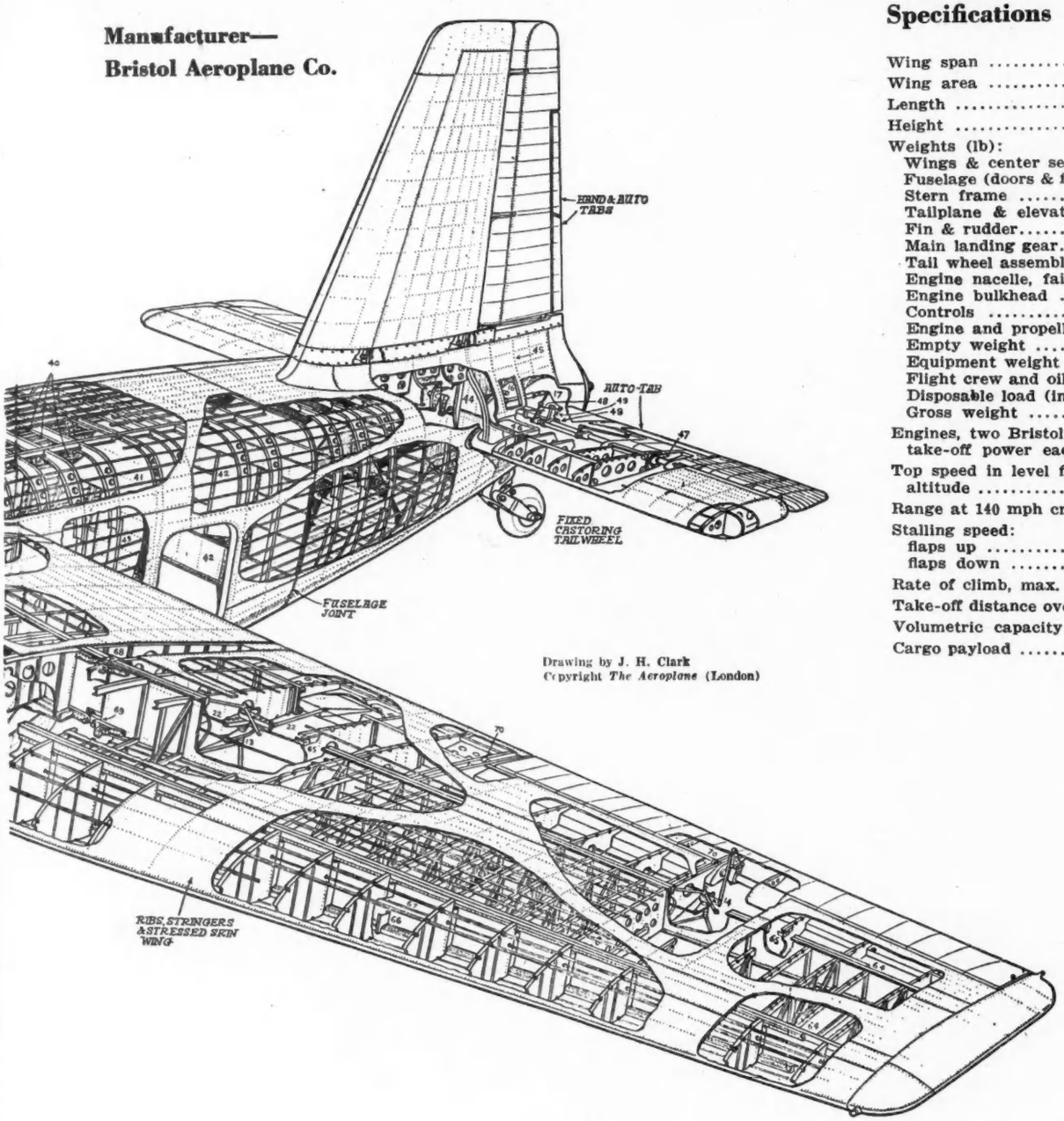
Flap Operation

Cockpit lever 18 opens valve 19 through rod 20
19—Valve (actuates ram 21 which lowers inboard and outboard flaps via links 22 and 24)
23—Ram travel causes rod 23 to travel back and close valve 19

Motor Controls

24—Cockpit levers
25—Cable runs
26—Instrument dashboard
27—Glycol sprays
28—Windshield wipers
29—Radio (to suit)
30—Control panel (electrical connections)
31—Hydraulic fluid reservoir
32—Glycol tank
33—Electric pump
34—Forward and aft fuselage floor spars
35—Box backbone to upper floor
36, 37, 38—Three-piece channel longeron
39—Metal box floor with wooden covering
40—Control cables between two roof girders
41—Bulkhead

Manufacturer—
Bristol Aeroplane Co.



Drawing by J. H. Clark
Copyright *The Aeroplane* (London)

Bristol 170 Freighter Specifications

Wing span	98 ft
Wing area	1405 sq ft
Length	64.3 ft
Height	21.7 ft
Weights (lb):	
Wings & center section	5,725
Fuselage (doors & floor included)	3,570
Stern frame	615
Tailplane & elevators	642
Fin & rudder	349
Main landing gear	1,900
Tail wheel assembly	137
Engine nacelle, fairings	408
Engine bulkhead	134
Controls	354
Engine and propellers	7,359
Empty weight	22,100
Equipment weight	1,382
Flight crew and oil	688
Disposable load (incl. fuel)	12,330
Gross weight	36,500
Engines, two Bristol Hercules 131's, take-off power each	1675 bhp
Top speed in level flight at 8000 ft altitude	236 mph
Range at 140 mph cruise	1085 miles
Stalling speed:	
flaps up	85 mph
flaps down	73 mph
Rate of climb, max. at S.L.	1135 fpm
Take-off distance over 50 ft barrier	2280 ft
Volumetric capacity	2360 cu ft
Cargo payload	10,000 lb

42—Bulkhead with door to tail
43—Roof and floor built as separate units, then fixed to verticals
44 and 45—Bulkheads complete with tailplane spar roots
46—Tailpane front fix (repeat for rear spar)
47—Elevator hinges to tailplane
48—Elevator shaft hinges to a fuselage member
49—Auto tab elevator drive dashpot

Undercarriage

50—Shock leg held by swivel 51 and struts 52 and 52A

To Align Landing-wheel

Remove pins 53 and screw the flanges 54 in and out of tube 55, so swinging the fork 56 a few degrees. This rotates leg 50 to turn landing-wheel a few degrees for track re-alignment.

Oil Cooling Regulation on Ground

Slip handle on to screwed spindle at 57 and turn. Spindle will screw out of fixed nut 58 and push door 59 open
60—Oil tank behind firewall 61
62—Air filter
63—Air grille

Wing

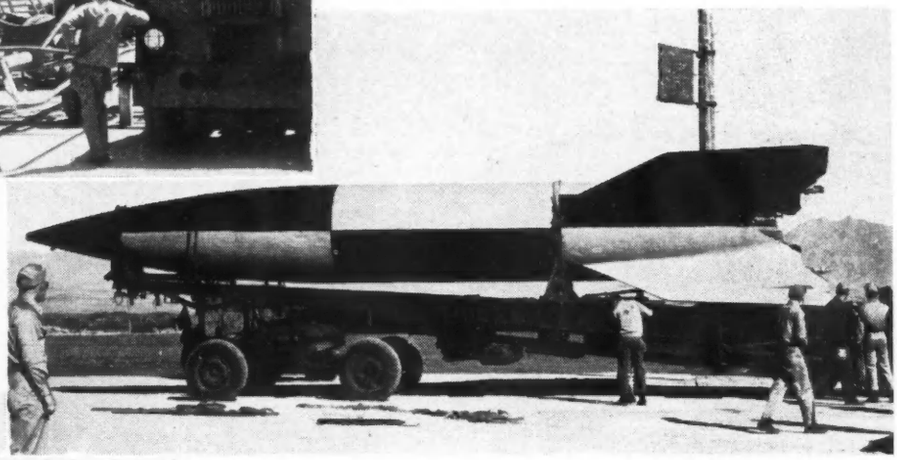
(A, B, C—6-point wing pick up fuselage)
64—End of tapering outer booms (angle booms carry on to wing tip)
65—Trailing-rib clip fixings
66—Leading edge rib channel fixings
67—Wing tip lamp conduit
68—Single-pin claw fix
69—Two-pin link fix (link forms jacking pad)
70—Aileron hinge
71—Inspection doors to cables in leading edge
72—Wing fix C longeron changes from double to single channel

Wayfarer Passenger Version

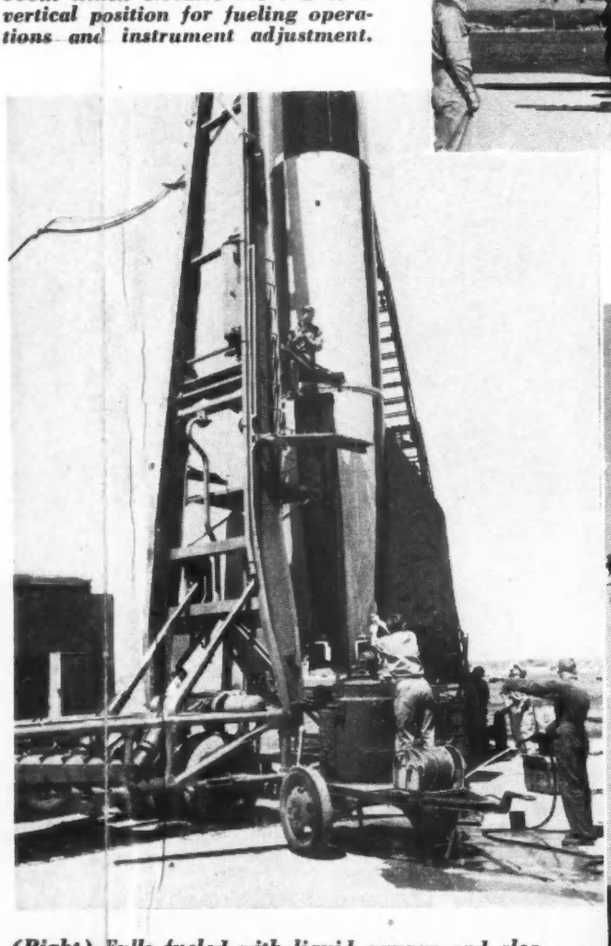
Solid nose instead of doors 1 and 2
Door at 73
Side windows rectangular instead of circular

Getting the V-2 into Action

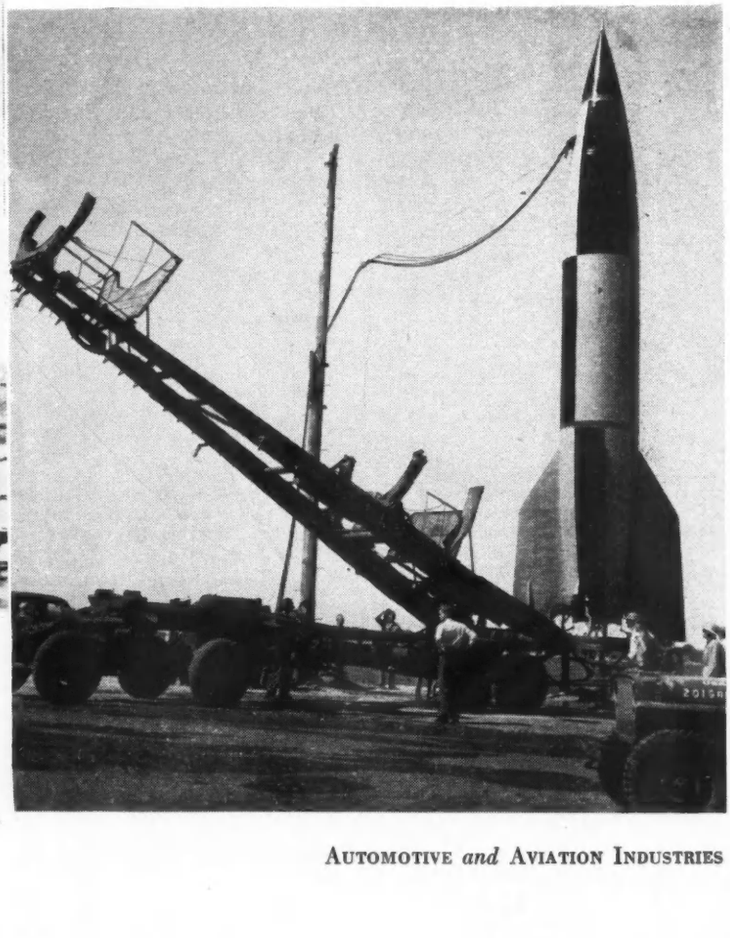
(Left) A captured German V-2 rocket is loaded on the specially designed Meiller Wagon after assembly at the Army Proving Grounds in New Mexico. Without its fuels, as delivered to the launching area, the V-2 (Army A-4) weighs approximately 10,000 lb.



(Right The 46 ft missile, which has a maximum diameter of 5.41 ft, is securely clamped to the ingenious boom which elevates the V-2 to a vertical position for fueling operations and instrument adjustment.



(Left) The self-contained, motor-driven hydraulic lifting system of the Meiller Wagon is clearly shown in this fueling photograph. The platforms swing into place for workmen. Fuel lines are built in, with quick connections at top and bottom.



(Right) Fully fueled with liquid oxygen and alcohol, and hydrogen peroxide and a permanganate catalyst to generate superheated steam, the rocket weighs nearly 28.000 lb. Fins are supported by a rotatable ring mounted on a steel trailer-type launcher which has been leveled by the adjustable legs. After Meiller Wagon was withdrawn, a thrust of 56,000 lb sent this rocket to a 75 mile altitude.

British Motor Industry's Jubilee

By Charles Fothergill

THE British motor industry this year celebrates its jubilee. It was on Jan. 14, 1896, that Harry J. Lawson, a London company promoter, registered the Daimler Company, the first manufacturers of motor cars in Britain, and thus laid the foundations of what in 50 years has become Britain's third largest industry.

When Lawson launched his company with a capital of £100,000 he was not without some knowledge of the horseless carriage, because during the preceding two years a handful of British enthusiasts had risked the public displeasure by importing a few models from the Continent, where freedom from restrictions had encouraged the development of the internal combustion engine.

At that time too, a small number of British inventors were privately engaged in the construction of steam and petroleum driven vehicles. In 1895 the Lanchester brothers had built the prototype of a car that eventually bore their name, while Herbert Austin, works manager of the Wolseley Sheep Shearing Co., Ltd., had built the first Wolseley car. But it was Lawson who, showing such foresight and implicit faith in the future of these clumsy, box-like vehicles, was first responsible for the horseless carriage being manufactured on a commercial basis in Britain.

The public ridiculed the idea. The Highways and Locomotives (Amendment) Act of 1878 then demanded that any mechanically propelled vehicle should be preceded by a pedestrian at a distance of 20 yards. Sometimes he carried a red flag, and every man's hand seemed to be raised against the "cranks" who trundled their high, ugly, noisy vehicles along the dusty highways at not more than the statutory speed of four mph.

Not only had these pioneers to contend with railway inspired restrictive legislation and public prejudice, but also the constant teething troubles of their carriages, broken chains and pulleys, erratic steering (often of the nautical tiller type), and defects in the solid wooden wheels (the rear pair larger than the front), to mention but a few. And what discomforts they suffered—the noise of the rough aircooled engine at the front or rear of the vehicle, perhaps directly beneath the driving seat; lack of any weather protection; the ignition provided by a small platinum tube kept at red heat by a burner; the exposed gears, and many others. The motorists of those days had to be engineers and tough.

But Lawson and his friends fought hard for the new-fangled contraption. They succeeded in getting a carriage included in the Lord Mayor of London's procession—a famous and popular spectacle — and during an International Exhibition of Motors, Horseless Carriages and Self-Propelled Cars at the Imperial Institute in London they persuaded King Edward VII, then the Prince of Wales, to disobey the Queen Mother and bravely take a ride in the latest wonder. Members of Parliament, who had been invited, were duly impressed, especially when a horseless carriage was driven up and down a ramp that had been erected in the Institute.

These efforts resulted in Parliament introducing the Locomotives on Highways Act, which permitted horseless vehicles to use the highways without the necessity of a pedestrian vanguard, and raised the speed limit to 12 mph. The pioneers, at last granted the freedom of the roads, celebrated with an Emancipation Run from London to Brighton. Many of the vehicles that took part in that joyful event in November, 1896, will participate in the great jubilee procession of motor cars that the Society of Motor Manufacturers and Traders hopes to organize this year prior to Britain's first postwar Motor Show in October.

Other enthusiasts joined Daimler, Lanchester and Wolseley in the manufacturing field, but public prejudice was still strong enough for some one to suggest in Parliament that as the steering of these vehicles was so uncertain, it would be better if ponies could be attached in front to give direction, leaving the engine to do the work! And this was the time when the Lanchester Brothers were incorporating in their cars such technical advances as the epicyclic gearbox with preselector control.

In 1900 a valuable fillip to the weakling industry was given by a 1000-mile trial, organized by the Royal Automobile Club, that not only afforded definite proof of the automobile's safety and reliability, but introduced the vehicle to the provincial cities which, up to that time, had heard only tales of the latest engineering marvel. In this event competed the first Riley, Lagonda, Humber, Napier, and Sunbeam cars which had made their appearance during the preceding two years. In that year too, the Prince of Wales took delivery of the first Royal motor car, and set a fashion that hundreds were quick to follow.

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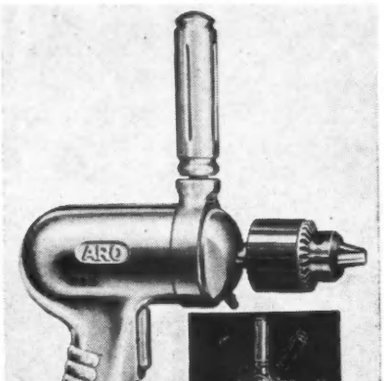


Air-powered Aro drill model 7016

A NEW air-powered ½-in. drill, Model 7016 designed and manufactured by the Aro Equipment Corp., 1914 Erie Ave., Bryan, Ohio, has been added to the line of Aro pneumatic tools.

This drill is built to the specifications demanded for heavy duty, continuous-production jobs—yet it is said to be 40 per cent lighter in weight than other drills of the same capacity. Ample power is provided for stall-proof operation on jobs of drilling, reaming and countersinking.

The drill is equipped with an auxiliary handle that can be instantly located in any position around the nose of the tool. The handle threads into a shoe located in a ring on the nose housing. To locate the handle in a new position, operator loosens handle with ⅛ counter-clockwise turn, moves to desired position, then locks handle by ⅛ clockwise turn.

The drill is equipped with the Aro safety throttle trigger that allows the operator to start and stop the tools with a minimum of effort, and control their operation efficiently under all conditions. Other features include: Extra large, heavy duty ball bearings which cushion the action of all moving parts and contribute to long life operation; rotors, cylinders and gears made of alloy steels ground to precision tolerances: built-in automatic oiler. The speed is 1000 rpm, weight 6¼ lb, and overall length is 8⅝ in.

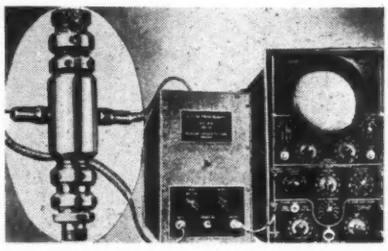
ELECTRO PRODUCTS LABORATORIES, 349 W. Randolph St., Chicago 6, Ill., have brought out a new Pressuregraph which embodies important improvements over previous models.

The new instrument provides, with a cathode ray oscillograph, a substantially linear pressure-time curve on the screen, which indicates the performance of any engine, pump, or other device subject to pressure variations. It is used for studies of all types of internal combustion engines, pumps, compressors, air and liquid pipe lines, etc. It shows instantly the erratic operation of a device which normally cannot be observed by other means, due to inertia of fly-wheels, and other factors.

It is used for Diesels, for C.F.R. aviation fuel test engines, two-cycle engines, and a wide range of other applications.

In addition to dynamic pressure variations, it shows static or slow pressure variations. It covers all mechanical speeds, and pressures up to 10,000 psi. There is no appreciable inertia to overcome in the electronic driving mechanism.

The new Pressuregraph provides means for temperature compensation. There are three output selections: 1), for double modulated wave; 2), for indicator card wave; 3), integrated single line providing means for transmission



Pressuregraph made by Electro Products Laboratories

of pick-up response to a string oscillograph, for photographic recording.

The pick-up has been completely redesigned. It has been made vibration-proof, and is furnished with or without water-cooling.

A TAP HEAD designed to fit any standard drilling machine has been developed by the R. G. Haskins Co., 615 S. California Ave., Chicago 12, Ill.

Haskins' tap heads are available in three sizes: No. 1, with either No. 1 or No. 2 Morse taper shank; No. 2, with No. 2 or No. 3 Morse taper; and the heavy duty No. 3, which comes with a quill type adapter only.

Where more permanent installation is desired, any of the above tap heads can be furnished with a special adapter or quill clamp to meet the installation requirements of the drill press. These adapters are made to the measurements of the drill press quill and spindle.

Each size head is designed to tap within definite capacities. When the tap contacts the blank, the clutch is automatically seated with cushioned effect in the drive shell, yet is sufficiently sensitivze that should the tap meet with an obstruction, the clutch is designed to slip, eliminating tap breakage. When the bottom of the stroke is reached, and the tap head is retracted, the clutch is immediately engaged by the reverse shell changing the rotation of the tap and permitting the operator to float the tap out of the tapped hole.

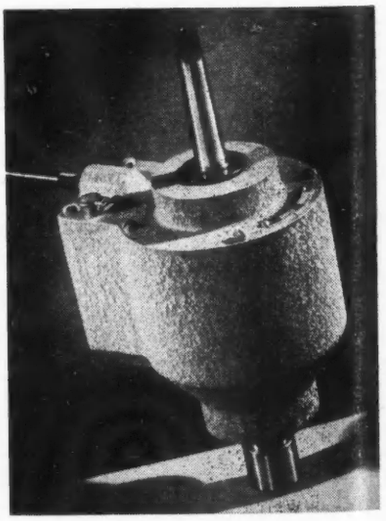
If desired, the Haskins head can be furnished with a special combination tapping and external threading spindle. Standard Acorn type dies can be used without any extra adapters or holders. Individual ground collets are available for each size tap.

Rated capacity in mild steel or brass is up to ¼ in. for the No. 1 tap head; No. 6 to ⅜ in. N.F. for the No. 2 head; and No. 8 to ½ in. N.F. for the No. 3 head. The tapper reverses out at twice the tapping speed.

AUTOMATIC TRANSPORTATION CO., 149 West 87th St., Chicago 20, Ill., manufacturer of the Transporter, has announced new improved models of this electric propelled hand truck. Further, Automatic reported postwar Transporters are now in production.

A new hydraulic lift pump which reduces by two-thirds the time necessary to get a Transporter load into moving position and a redesigned brake four to five times as powerful as that on the old model are outstanding new features.

The pump's performance is achieved through combination of low pressure (high speed) cylinder for raising the platform into contact with skid or pallet and high pressure (low speed) cylinder for raising the load. As soon as the platform encounters the load resistance, the fluid from the low pressure cylinder by-passes back into the



Haskins drill press tap head

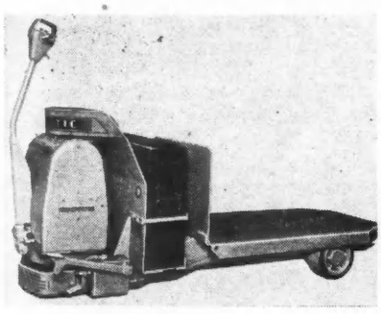
New Production and Plant Equipment

reservoir and the high pressure cylinder raises the load. The new pump is interchangeable with the old and is available and can be installed on all Transporters now in service.

"Dead-man control" is provided by the new brake. It is applied automatically by release of the guide handle and will bring a fully-loaded Transporter to an immediate stop even on grades up to ten per cent, the maximum commonly encountered by material handling equipment.

The Transporter's heavy-duty industrial truck type series wound d-c motor has been redesigned for the postwar models. Improvements include improved brush holders, redesigned commutator cover and relocated leads.

Structural changes in the postwar Transporter constitute a complete redesign of the driving unit. Principal modifications include a new magnetic contactor with silver alloy tips that do not "build up" or "crater" new commutator type collector rings equipped with carbon brushes eliminating the need for lubrication, simplified controller with reduced number of contacts,



Postwar Transporter

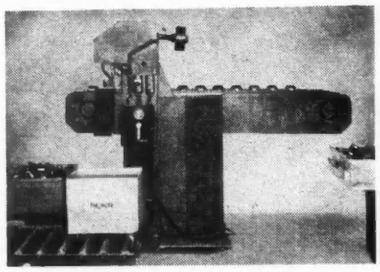
larger and stronger double-pitch reduction chains, strengthened countershaft, larger countershaft bearings to compensate for larger brake and simplified wiring.

In addition to these major modifications, other improvements include relocation of the resistor to permit access to the motor, increase in diameter of the turntable, addition of a heavy pressed steel chain guard, addition of a heavy steel front bumper, extension of thumb guard on the steering handle, change to double-pitch chain sprockets, and reduction in number of lubrication points.

The new Transporter is being made in four models: 4,000- and 6,000-lb capacity platform types for skid platforms; 4,000-lb capacity fork type for pallet loads; and a special 3,000-lb capacity fork model for tin plate.

Standard equipment includes a battery capable of at least eight hours' operation. A portable cabinet plug-in charging unit is available.

LINK ENGINEERING CO., 13851 Elmira St., Detroit, Mich., has built a machine for determining the load characteristics of automotive engine mountings. Known as the Link-Reising machine, it automatically rejects mount-



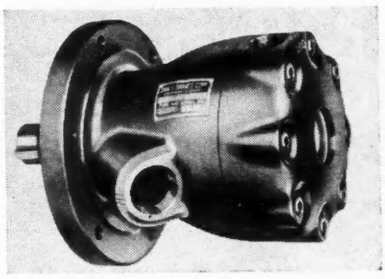
Link-Reising machine

ings that do not meet minimum or maximum deflection specifications under static load conditions.

Weights are used to apply pressure to the parts being tested as they are brought under the adjustable head by a conveyor chain. The conveyor is driven through a Geneva drive mechanism that permits it to stop while the load is applied. Limit switches actuate a solenoid arm that rejects mountings having load characteristics outside the predetermined limits. A rod type ejector is available for parts without steel inserts. Parts are checked at the rate of one every three seconds.

E. F. Reising, chief automotive engineer, Firestone Industrial Products Co., designed the Link-Reising machine.

THE JOHN S. BARNES CORP., 301 S. Water St., Rockford, Ill., has added the Barnes Equalized Roto-Blade pump to its line of hydraulic units. This new pump is available in many combinations. It can be had as a single pump, double pump, single pump with feed pump, double pump with feed pump, and a single pump with gear pump. Capacities of pump range from 8.5 gpm to 50 gpm, and working pressures to



Barnes Equalized Roto-Blade pump

1000 psi continuous or 1500 psi intermittent.

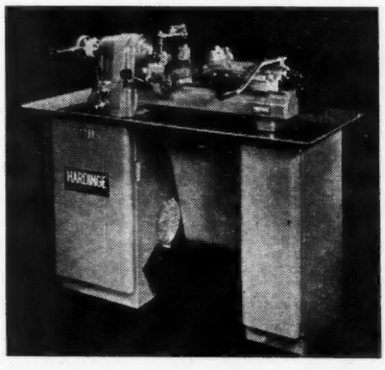
Two important factors are said to be responsible for the life and efficiency of the Barnes Equalized Roto-Blade pump. One is that bearing loads are neutralized by equalized and diametrically opposed radial hydraulic thrust loads. The second factor is that the impeller assembly, which includes the bushing and all moving parts, may be readily removed and a new impeller assembly inserted if long service makes such a step desirable.

HARDINGE BROTHERS, INC., 1418 College Ave., Elmira, N. Y., have developed a new model high-speed second operation machine. Known as the Model DSM59, it incorporates all of the features of other Hardinge second operation machines in addition to the following features.

The steel bed ways are of the improved dovetail design. These ways are ground to master gages after hardening. The dovetail bed ways form a solid steel bed top. The design of the dovetail way protects the accurate angular way surfaces from falling chips and foreign matter. The bed has a three point mounting on the welded steel pedestal base.

The fully-enclosed headstock has a preloaded ball bearing spindle construction. The spindle is ground to take standard 1-in. capacity 5C Hardinge collets and 6-in. capacity step chucks. The spindle nose is supplied

(*Turn to page 98, please*)



Hardinge second operation machine

Airbriefs

By Robert McLarren

Radio Maps

Radio transmission of complete facsimile weather maps to planes in the air, thereby eliminating the laborious plotting of isobars and pressure areas from coded teletype messages to ground stations and providing complete meteorological data in easy-reading pictorial form, will soon be a standard procedure. Representatives of the AAF, Navy, Signal Corps, Weather Bureau, A.T. & T. and several foreign governments discussed the problem in a two-day New York City session and drew up organizational plans. These are expected to crystallize at coming sessions of the Aviation Meteorological Sub-Committee of the Air Coordinating Committee, Washington, D. C., and at the conference of the International Meteorological Organization in Paris. Advantages of the facsimile system are its high-speed, elimination of costly duplication of effort and the inclusion of considerably more weather information than presented heretofore.

Liquid Ignition

Captured German technical data reveal a liquid-ignition system which provides fuel savings up to five per cent, knock-free performance and a 600 per cent increase in spark energy release. The system consists of diethyl-diglycol-ether which, when sprayed into the cylinder, is ignited by the heat of compression. Such a system would eliminate the weight, power-drain, high-altitude faults and radio interference difficulties of the present electric spark ignition and save as high as 50 gal of fuel per hour on current airline transport planes. It was developed by I. G. Farben Industrie A. G. in collaboration with Bayerische Motoren Werke, aircraft engine manufacturers.

Supersonic Projects

Supersonic aircraft are now under development by Douglas Aircraft Co., Inc., and Bell Aircraft Corp. Both are Navy projects, but details are closely restricted. They are man-carrying designs, however. Preliminary data on high speed design configuration have been obtained for the Bell project on a special P-63 Kingcobra fitted experimentally with 35 deg sweepback wings. Although speed of this test plane is far from supersonic, the tests have produced valuable design data. Most authoritative data available today indicate at least 45 deg sweepback will be required for any significant gains. Stability and control problems on swept wings remain largely unsolved at present with flaps, elevators and rudders losing their effectiveness at transonic speeds.

Westinghouse Jets

The Navy Department has revealed that early flight tests on the Westinghouse X-19A turbo-jet engine were conducted in a specially-equipped Martin JM-1 (Navy B-26 Marauder). The unit was mounted in the extreme aft end of the fuselage with air provided from large air intake ducts along the aft fuselage. Vital data on starting and acceleration, performance information such as thrust, fuel consumption, air flow, temperatures, etc., and tests of speed governors, all at various flight speeds, altitudes, climbs and dives were obtained. This parallels the AAF's experiments with General Electric turbo-jet units in the tail of a Consolidated B-24 Liberator which are reported to have driven the airplane with all four engines idling.

Mixmaster

A Douglas Aircraft Co., Inc., executive states that plans for the DC-8 Mixmaster transport have NOT been shelved. Detailed engineering is being delayed, however, while various internal layouts are studied by interested airlines. The latter are still definitely interested in the unorthodox pusher airliner because of its greater load and lower operating costs than competitive models now under construction.

Navion Schedule

North American Aviation, Inc., has upped its production plans for the four-place Navion lightplane to 750, about three times earlier announced schedules. NAA has received a seemingly endless stream of orders for the $6100 all-metal plane.

Engine Synchronizer

Chicago and Southern Airlines will shortly place in operation the first commercial application of the Hamilton Standard Propeller automatic engine synchronizer. The unit weighs 10 lb and is all-electric. It maintains all four engines of a DC-4 in "synch" through the use of a "master" unit and three "slave" units. The system is adequately protected through individual cutouts which function when the "master" unit varies more than three per cent from its operating rpm.

New AAF Type

Consolidated-Vultee, Boeing, Piper, Bellanca and Ludington Griswold, the latter a newcomer, have submitted designs for a new liaison artillery-spotter type of the AAF for evaluation. First AAF design or procurement competition since 1939, the move is the first indication that the AAF will return to its prewar competitive procurement system, which industry leaders have vigorously opposed in Congressional testimony.

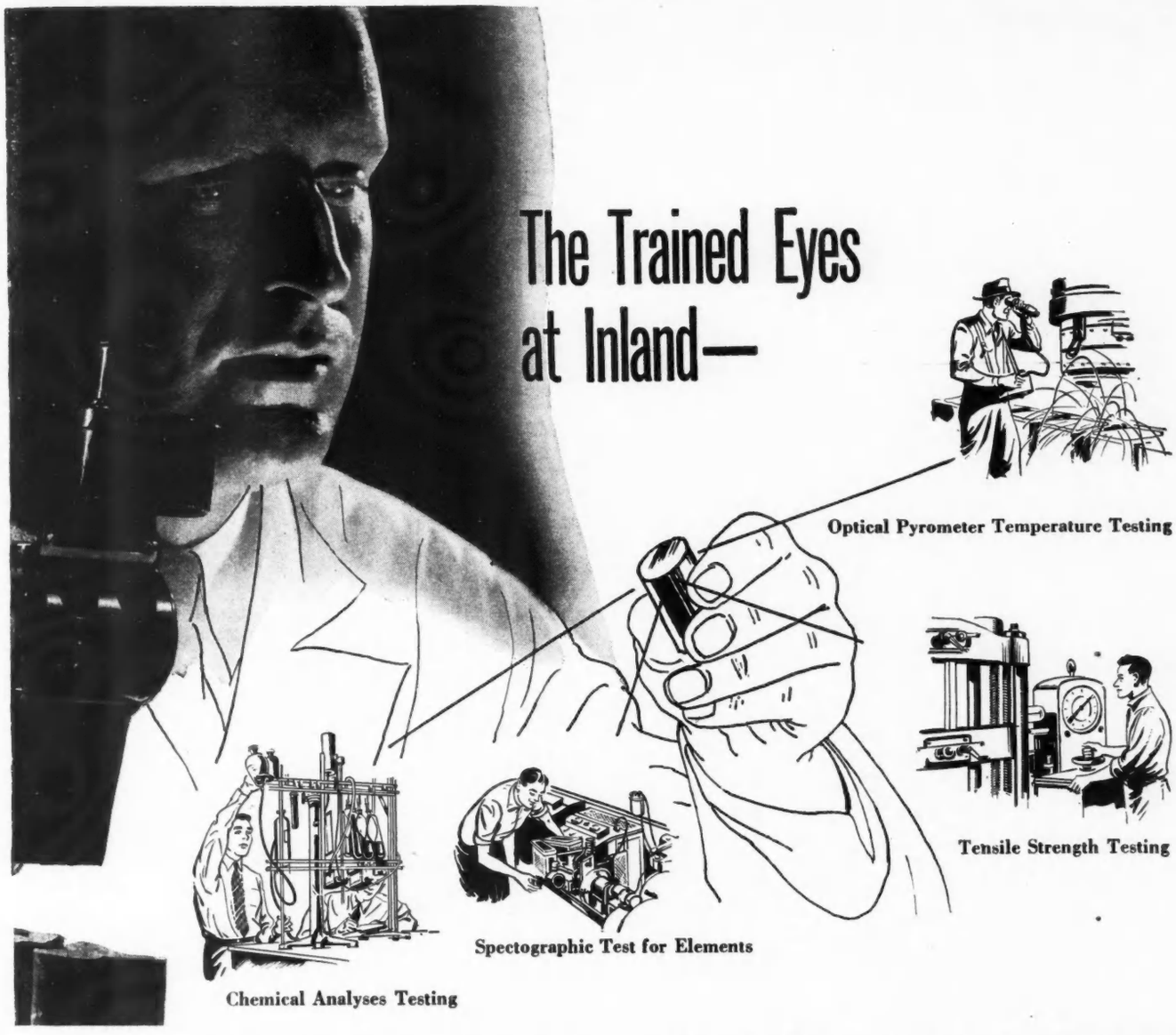
Plated Propeller

Navy Bureau of Aeronautics has developed a nickel-plated wooden propeller which is claimed to exhibit the durability of all-metal designs at a fraction of the cost. Manufactured by Bone Engineering Corp., the propeller is fabricated by immersing the preformed blade core in nickel electroplating solution. Plating can be controlled to provide extra leading edge thickness, thin trailing edge coating. Composite material soft core-hard shell materials are being pushed by the Navy at numerous metal, aircraft and development firms.

Consumer Goods

Kellett Aircraft Corp., North Wales, Pa., is another long-time aircraft manufacturer now converting to consumer goods production. Although the firm is still at work on AAF developmental contracts for the radical XR-8 helicopter, it will manufacture refrigerators, deep-freeze units, automotive parts, electrical items, etc., in the future. W. Wallace Kellett states, however, that work on a new and revolutionary transport helicopter, now in the design stage, will be continued.

(*Turn to page* 112, *please*)



The Trained Eyes at Inland—

Optical Pyrometer Temperature Testing

Tensile Strength Testing

Spectographic Test for Elements

Chemical Analyses Testing

Every day, year in and year out, ton after ton of steel passes the scrutiny of Inland's "trained eyes" . . . Samples are gathered from all operations and subjected to exacting tests before the steel is permitted to be rolled into final form.

Chemical analysis maintains a careful control over all elements . . . holds them in proper proportion and within rigid tolerances. Further control is possible by means of the spectograph and the comparator, that present a graphic record of the exact composition. Optical Pyrometers eliminate guesswork . . . allow operators to control temperatures accurately at all times. In addition, tensile, hardness and metallographic tests are conducted to maintain satisfactory properties. The combined control exerted by these tests is assurance of the quality fabricators can expect . . . and get from Inland Steels.

Inland steelmakers working together closely, carefully on each individual order means *that* order will "measure up" to every requirement when delivered.

Inland Steel Company, 38 S. Dearborn St., Chicago 3, Illinois. Sales Offices: Cincinnati, Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul.

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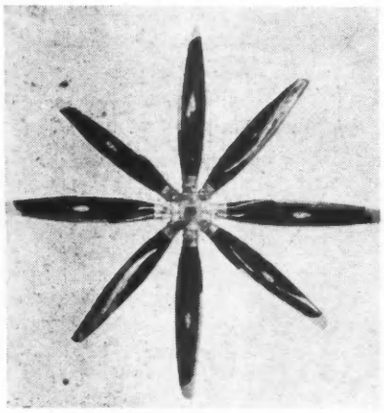
INLAND STEEL

New Products for Aircraft

Propeller Features Eight Blades and Counter Rotation

Details of an experimental 11½-ft diameter Aeromatic counter-rotating eight-bladed propeller, created in the research facilities and machine works of the Koppers Co., Inc., Bartlett Hayward Division, for the Bureau of Aeronautics, United States Navy, were disclosed recently.

Designed for an airplane having a 2500-hp engine and a speed in excess of 400 mph, the new propeller unit consists of two four-bladed propellers arranged closely in tandem and mounted on coaxial shafts to rotate in opposite directions.



Frontal view of Aeromatic counter rotating propeller

Operating on the same principle as the small Aeromatic lightplane propeller made by Bartlett Hayward, the counter-rotating Aeromatic governs the speed of one or two engines automatically through a wide range of air speeds and maneuvers. This is possible due to the use of the principle of "propulsion by physics" whereby only natural physical forces are utilized to change blade angles, an action similar in result to that of an automatic automobile transmission.

By the use of these forces, electrical or hydraulic "gear shifting" is eliminated. This results in what is perhaps the lightest, high horsepower propeller ever constructed and the first such use of purely physical forces for pitch changing in a high horsepower range. Besides the absence of pitch control devices, conventional metal blades are replaced with high strength plastic-bonded plywood and covered with hard Aeroloid plastic sheeting. Use of this improved wood is said to produce a blade of less than half the weight of a comparable metal blade.

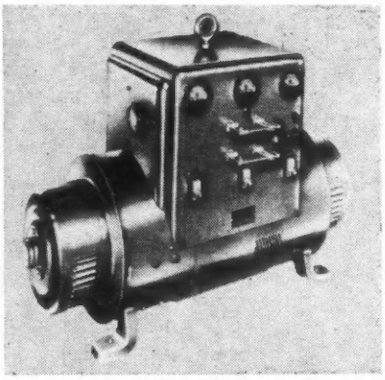
The 65-600 hp range of Aeromatics which are currently being produced for five principal light planes will remain the firm's main line of endeavor in propeller production.

Aircraft Battery Charger

A double-commutator, dual-voltage generator set for both 12- and 24-volt aircraft batteries has been brought out by the Motor Generator Corp. Division of the Hobart Brothers Co., Troy, N. Y. Available in four models of three, six, nine and 12-battery capacity, this generator was designed especially for charging 12 and 24 volt aircraft batteries simultaneously. Six volt batteries can also be charged by connecting two in a series on the 15-volt circuit.

The Model No. 502 generator is constant voltage compound wound with interpoles, 1½ kw rated 100/50 amp at 15/30 volts, direct current. This dual voltage generator delivers 15 volts at 100 amp with the commutators connected parallel or 50 amp at 30 volts when they are connected in series. This permits charging of both 12 and 24 volt batteries.

A three-phase, four hp, 220/440 volt, 60 cycle, across-the-line induction type motor and the exciter are built on a common shaft with the generator. The exciter is said to guarantee constant voltage and prevent polarity reversal.



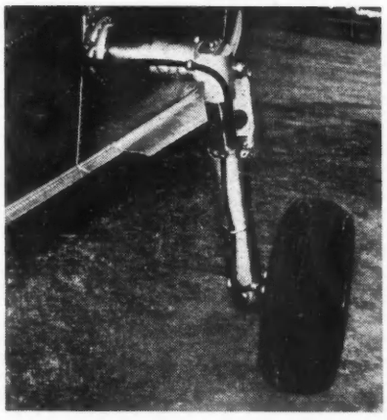
Model No. 502 generator set

The control cabinet houses two ammeters (one for each commutator), one voltmeter, voltmeter switch (to read voltage of either commutator), field rheostat, two pole single throw disconnect switch, across-the-line motor magnetic type starting switch with start-stop push button station—three d-c distribution terminals.

Landing Gears for Light and Medium Weight Planes

Electrol, Inc., 1000 Grand St., Kingston, N. Y., is producing a series of landing gears especially designed for use on medium and light weight personal planes.

Two of the features incorporated in the Electrol landing gears are the use of stationary bearings in the oleo assembly that eliminate sliding contact between the piston and the cylinder wall and the employment of spacers that separate the various elements and make for quick and accurate assembly.



Electrol landing gear

Electrol landing gears are currently available in several models. Model 400-1 weighs 11.5 lb, has a load factor of 2.8 and stroke of 5 in., and is designed for aircraft weighing 1500-2500 lb. Model 400-2, specially designed for the Seabee, can be used on a plane with a gross weight of 3000 lb and has a limit load factor of 2.65 and a stroke of 8 in. Model 400-4 has been designed for use on a retractable undercarriage on an aircraft grossing 2500 lb. It has a 6-in. stroke. The Model 400-5 (installed on the Commonwealth Trimmer) weighs 4.6 lb and is designed for airplanes with a gross weight of 2500-3500 lb. Another model has been designed for use on aircraft having a gross weight as low as 1200 lb.

All-Purpose Fuel for Light Aircraft Engines

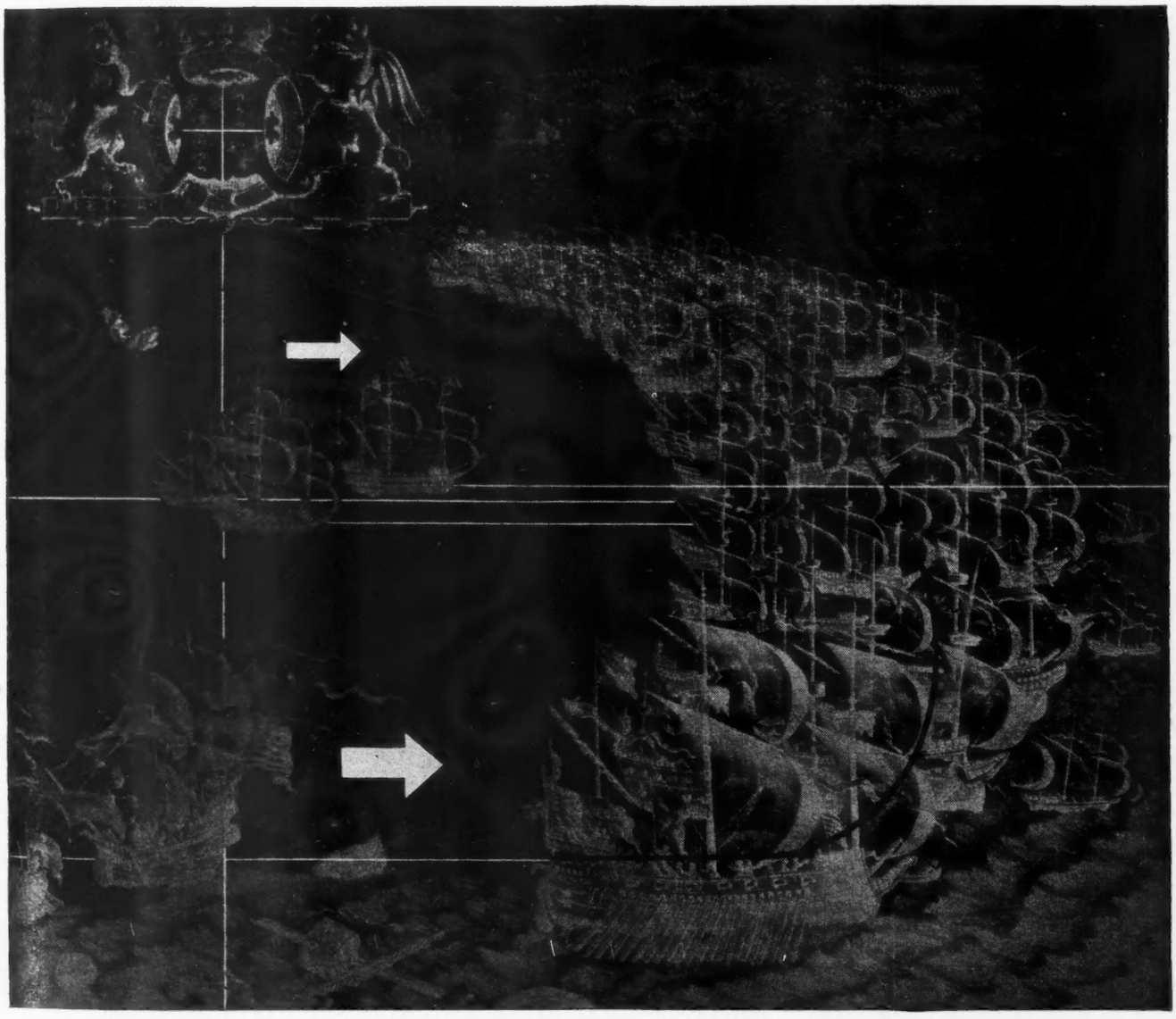
Development of a new 80-octane unleaded aviation gasoline for all light plane engines which permits higher knock-free performance than former leaded fuels and which provides a single fuel for both flying and maintenance operations is announced by The Texas Company. Known as Texaco 316 aviation gasoline, this custom-built fuel replaces the following Texaco products: 73- and 80-octane leaded fuels.

(*Turn to page* 106, *please*)

A LITTLE DOES A LOT

The Spanish built their colossal Armada to smother England by sheer weight. But Drake, with a scratch fleet of nondescript ships, and some brains, reduced the Armada to an unpleasant memory.

Not only in warfare can a little do a lot, intelligently applied. Today a little molybdenum is doing a lot to improve the strength and toughness of good cast iron. The foundry man's market is broadened and many a user's production headaches relieved. Practical working data is available on request.



MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

Climax Molybdenum Company
500 Fifth Avenue - New York City

MOLY

Observations

BY JOSEPH GESCHELIN

Standards Legality

ENGINEERS doubtless will learn with some surprise that the establishment of national standards in the interest of simplification is subject to scrutiny by the Federal Trade Commission and has been attacked in certain important cases involving restraint of trade. For a complete discussion you are referred to April, *Industrial Standardization* which contains an article by James D. Hayes on this subject. In the present state of the anti-trust law, Mr. Hayes advises that "the activity is legitimate in the absence of any agreement by the participants to limit their production to the standard items." As a corollary of the voluntary character of standardization, an association engaged in standardization takes no steps to compel compliance with its standards. On the other hand such associations are free to investigate to see whether their standards are being followed for the purpose of verifying their validity and possible need for amendments. Such activity is considered proper if carried on in good faith.

Night Driving

ALTHOUGH night driving still presents serious hazards because of glare and poor visibility, the present sealed-beam headlighting system remains the most practical and effective means of lighting known to the industry. Out of the many suggested improvements, Polaroid stands out as the only real contribution to safety. Were it not for its relatively high cost in the present state of the art, undoubtedly it would find ready acceptance. From a practical standpoint Polaroid has come a long way since its introduction. The plastic sheet is durable, effectively resists weathering and heat. Moreover, it has been found that the plastic sheet can be used as a sandwich for making safety glass thus solving another cost problem. Nevertheless, it is inescapable that Polaroid absorbs close to 60 per cent of emitted energy. To have the same degree of seeing on the road takes considerable light energy —some say it requires a bulb of 100 to 125 watts to do the trick.

Some estimates have it that with Polaroid lenses and visor, the generator capacity must be around three times present ratings. We need a larger generator, heavier wiring, larger switches and protective devices. Relays are more expensive but would simplify wiring materially. The question facing the industry is—how much will the traffic bear in the interest of safety? Can it afford a factory cost of say $10 to $15? Perhaps that will be answered when the roads again swarm with millions of cars and trucks.

If Polaroid were adopted, the front end probably would have four lamps—two Polaroid headlamps, and two lamps mounted lower, doubling in brass, for city lights and fog lamps. The latter also could incorporate the turn signals. Here is a development well worth the attention of everyone concerned.

Light Metals

NOW that facilities for producing aluminum and magnesium are so abundant there is opportunity for designers to reappraise their current products or consider their new designs with a view to the utilization of the light weight materials. Recently one of the large producers of magnetos shifted to aluminum die castings for the rotor, frame, and other parts. This change has reduced the weight of magnetos making them more attractive for installation on small engines. Naturally price still is an important factor. But there are many places where light weight actually pays dividends—on heavy duty motor trucks, to mention one outstanding example. The judicious use of inserts for fastenings considerably extends the field in which these lighter metals may be used.

Small Lots

TIME was when small-lot production was almost synonymous with high cost, at least by comparison with mass production. But modern methods and machinery have thrown this concept into discard. By proper planning of runs, by proper scheduling of runs, and by the development of the right methods small lots can be produced with gratifying economy and well in line with that of higher runs. Good examples of what we mean are to be found in many places throughout the industry. And there is plenty of room for more.

Quality Control

HAVING followed and supported the technique of statistical control as a method of value in automotive plants, this department is glad to note the formation of The Society for Quality Control, 305 East 43 St., New York, N. Y. The present organization is expected to serve in an interim capacity pending establishment of a national society with local chapter participation.

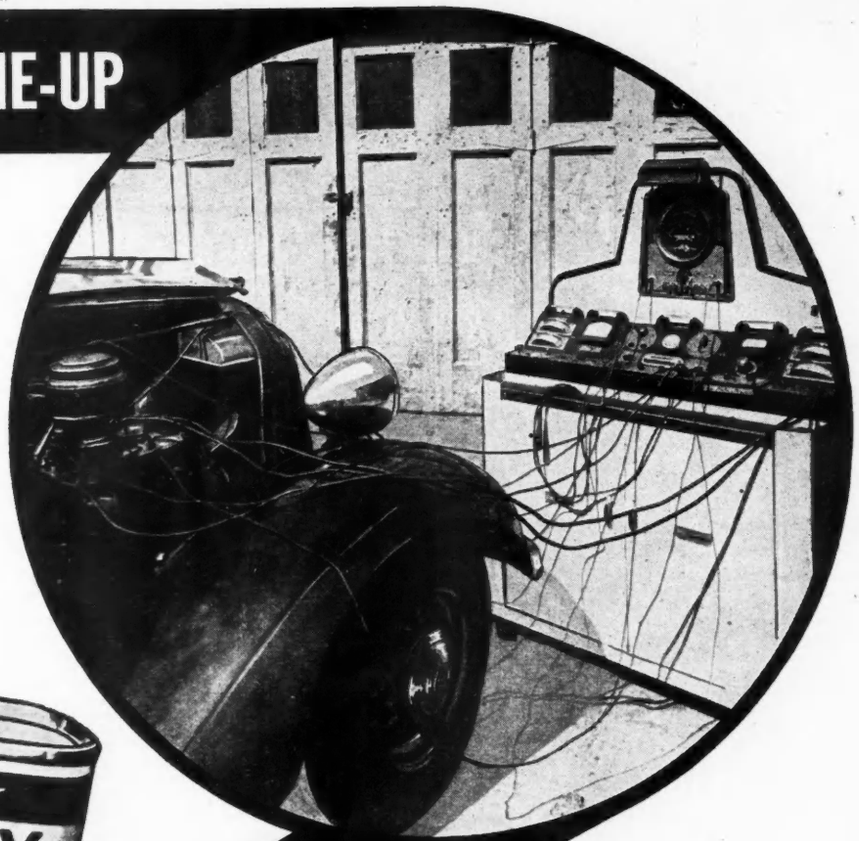
Drill Specials

SMALL bench type drills such as are made by a number of manufacturers have been used for many purposes in the past. The pinch of the war, however, stimulated the use of such drills in multiple-spindle and special purpose set-ups in which a number of such drills were mounted on a suitable base to provide in effect a special purpose machine. During the shortage of machine tools the virtue and economy of this practice were well demonstrated. With things back to normal master mechanics can profitably adopt this practice in many places where the cost of special machines is not justified or where the ends of production can best be met with relatively low cost equipment of this nature.

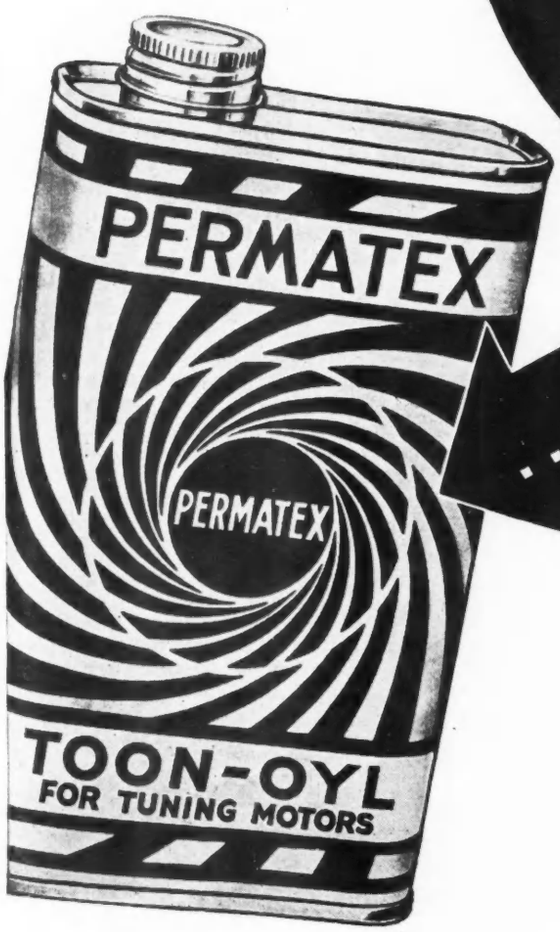
Re Bumpers

ALTHOUGH the standardization of bumper height for motor cars and light commercial vehicles has been a topic of discussion for many years, no standard has yet been published. And cars at the curb and on road still are locking horns. Speaking of bumpers some time ago we were intrigued by a cartoon showing a heavy guard rail extending completely around the vehicle. Fanciful to be sure. But with the trend to wider bodies enveloping the fenders, something like that seems necessary if we are to protect body contour.

BEFORE YOU TUNE-UP



... USE THIS



FIRST, add PERMATEX TOON-OYL to crankcase oil to dissolve sludge and gum binders that interfere with the smooth operation of valves, piston rings, oil lines and oil screens.

THEN you'll have a CLEAN ENGINE... ready for accurate mechanical adjustments!

℞

ADD 1 QUART OF PERMATEX TOON-OYL TO 5 OR 6 QUARTS OF ANY TYPE OF MOTOR OIL IN THE CRANKCASE

PERMATEX COMPANY, INC., BROOKLYN 29, N. Y.

New Products

Improved Bucket Pump

Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis, Mo., announces a new bucket pump known as the "Porto-Pak." This improved high-pressure grease gun is of all steel construction and holds 30-lb of lubricant.

Porto-Pak bucket pump

The Porto-Pak features a positive automatic venting device in the pump tube assembly which operates instantly when the pump handle is raised momentarily to topmost position. This venting device relieves pressure in the hose assembly permitting lubricant to drain back into container, saving lubricant and eliminating dripping when coupler is disengaged from the grease fitting. The venting device is wear-proof and has no moving parts or springs.

Operation is by up and down pumping action. The full open top provides maximum filler opening. The top is easily removed by loosening two thumbnut fasteners. A follower plate may be used when pumping heavy lubricants.

Self-Emulsifying Solvent

A self-emulsifying, water-mixable solvent, called Oakite composition No. 98, that removes light shop dirt and non-pigmented stamping compounds from steel and aluminum work, has been made available by Oakite Products, Inc., 22 Thames St., New York 6, N. Y., for use primarily in pressure-spray washing machines.

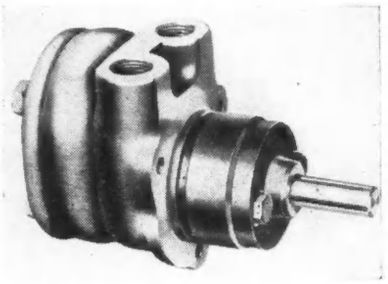
Non-toxic, non-inflammable in solution, the new material is reported to have important self-cleaning properties. It employs the principle of "constant-float" protection. The lighter-than-solution soil floats at the top of the cleaning tank to blanket and protect the clean solution underneath, retard foaming, and prevent material loss by evaporation. The "floating layer" is periodically skimmed or caused to overflow to avoid excessive thickening. The new solvent also prevents formation on clean work of water spots, which often show through clear lacquer and other types of organic finishes.

Working concentrations for Oakite composition No. 98 range from one to two per cent by volume, and maximum temperatures should not exceed 150 F.

Rotary Pumps for Wide Range of Uses

The Geo. D. Roper Corp., 303 Blackhawk Ave., Rockford, Ill., has brought out a new series of rotary pumps. Known as the Series K, they are available in three sizes—¾, 1½, and 3 gpm. They are easily adapted to a wide range of jobs such as Diesel fuel oil transfer work, pressure lubricating jobs, fuel supply duty, and many similar applications pumping clean liquids.

To make these new Roper pumps



Roper Series K rotary pump

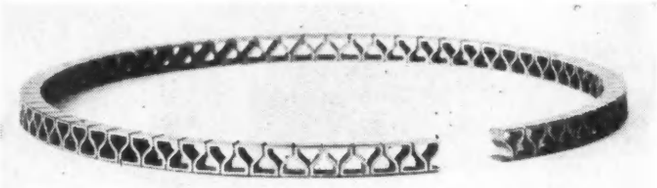
easy to adapt, varied mounting arrangements are provided. They can be hub, flange, or foot mounted. With separate mounting brackets provided to suit requirements, they are easy to use as a replacement. Complete units are also available with bed plate and motor, or fitted to receive motor.

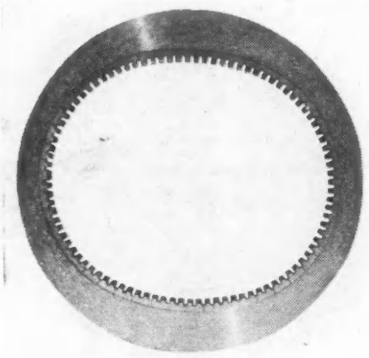
The Roper mechanical seal provides positive sealing action. Designed for clean liquid applications, it is said to operate efficiently at temperatures as high as 250 F. The seal is both self-aligning and self-adjusting, sealing tighter with any increase in pressure.

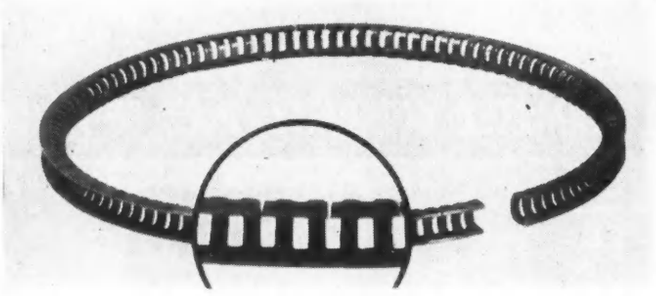
Thompson Announces Two New Piston Rings

An entirely new concept in oil control piston rings has been announced

(*Turn to page* 66, *please*)







(Lower right) *U-Flex piston ring*
(Top right) *Z-Flex piston ring*
(Left) *U-Flex ring in out-of-round cylinder*

The Way To Lower Unit Costs On Your Alloy Steel Parts

---------FOR LOWER COSTS ALL ALONG THE LINE---------

Saving time in production is the way to cut unit costs. The operations shown here are a few examples of spots where some manufacturers have cut costs by finding a Carpenter Special Purpose Alloy Steel to *fit the job.*

And on *your* jobs, you will also be interested in an alloy steel to—

- Meet unusual toughness and wear requirements
- Pass magnetic particle inspection
- Provide extra safety in resistance to fatigue
- Give you improved machinability
- Have a high finish after machining
- Resist heat effectively
- Respond uniformly to heat treatment
- Have a combination of good toughness and hardness, yet be soft enough to machine well

Carpenter Special Purpose Alloy Steels are made to tool steel standards. And that is important to you, because Carpenter furnishes the alloy steel you need . . . with a finish, or heat treatment, or close tolerance that often *eliminates an operation* on the steel in your plant.

Let us take a look at the blueprint on some alloy steel part where you have had trouble from the standpoint of production or performance. And for further information on the cost-saving possibilities with Carpenter Special Purpose Alloy Steels, ask for "Fitting the Steel to the Job." This 16-page booklet is yours for the asking.

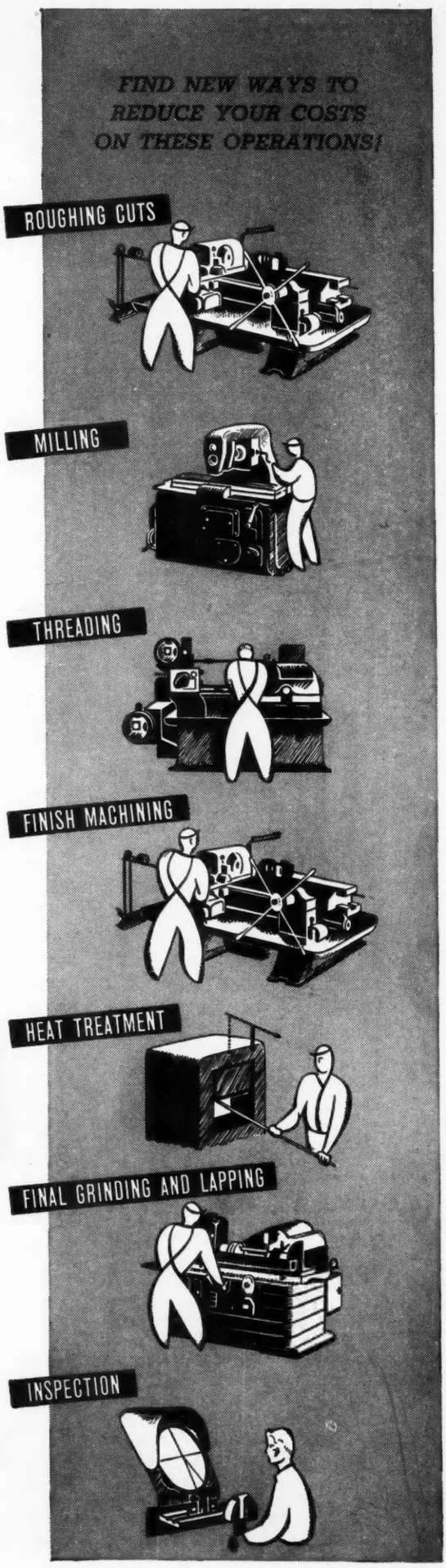
Carpenter

SPECIAL PURPOSE

ALLOY STEELS

. . . made in a tool steel mill
. . . inspected by tool steel standards

THE CARPENTER STEEL COMPANY • 103 W. BERN STREET, READING, PA.



NEWS *of the* Industry

With automobile production for May showing a drop from the April level and prospects for any great improvement in June exceedingly bleak, it becomes increasingly clear that something is organically wrong, not only in the automobile industry, but in others as well. The poison that is insidiously sapping the American productive system is not hard to locate, but is proving exceedingly difficult to neutralize. The one thing that is largely responsible for the creeping paralysis of the industrial economy today is strikes, strikes, and more strikes.

It is not enough to say that with the railroad and soft coal strikes settled, the roadblocks to production have been removed and that improvement will be the immediate result. Because these two stoppages were immediate and deadly in effect, they received top billing in the nation's consciousness, but they were actually only the projected and amplified images on a national scale of the thousands of localized work stoppages which have descended on the country since the end of the war like a plague of locusts. In total effect, these smaller strikes probably are just as costly and calamitous in lost production as the railroad and coal strikes, but because their effects lack the force of concentration, it just takes longer to accomplish the same end. That is the real reason why automobile production is making such a sorry showing today. Before the rail and coal strikes, car production was halting and fitful; now that they have been settled, output still will lag for many weeks and perhaps months because of the present and impending trouble among parts and materials suppliers.

Prospects Bleak for Improvement in Production Rate . . . Many Strikes at GM Suppliers . . . Car Output Declined During May . . . New Wage Drive May be in the Making . . . Cars Still Produced at a Loss Despite Recent Price Increases

General Motors Report Shows 143 Supplier Strikes

A good indication of how strikes in supplier plants is curtailing production seriously is shown by a report issued by C. E. Wilson, president of General Motors. Output of G.M. cars, he said, will fall short of original production schedules for the months of May, June, July, and August by more than 200,000 units because strikes in the plants of parts makers and other suppliers. As of May 20, the total number of stoppages affecting all G.M. divisions was 394. When duplications were eliminated, the net was 143 separate strikebound suppliers, exclusive of those supplying coal. At about the same time, the number of Ford suppliers hit by strikes had climbed to 52. Mr. Wilson said that production is running at about one-third what it should be at this stage of reconversion, and that because of labor troubles, the corporation has produced as of May 24 only 222,736 cars and trucks since V-J day, about 750,000 fewer than could have been turned out had not strikes and shortages caused by strikes intervened. He added that the current wave of strikes amounts to organized unemployment and is a national disaster.

Record of Shutdowns Shows Spotty Supplies

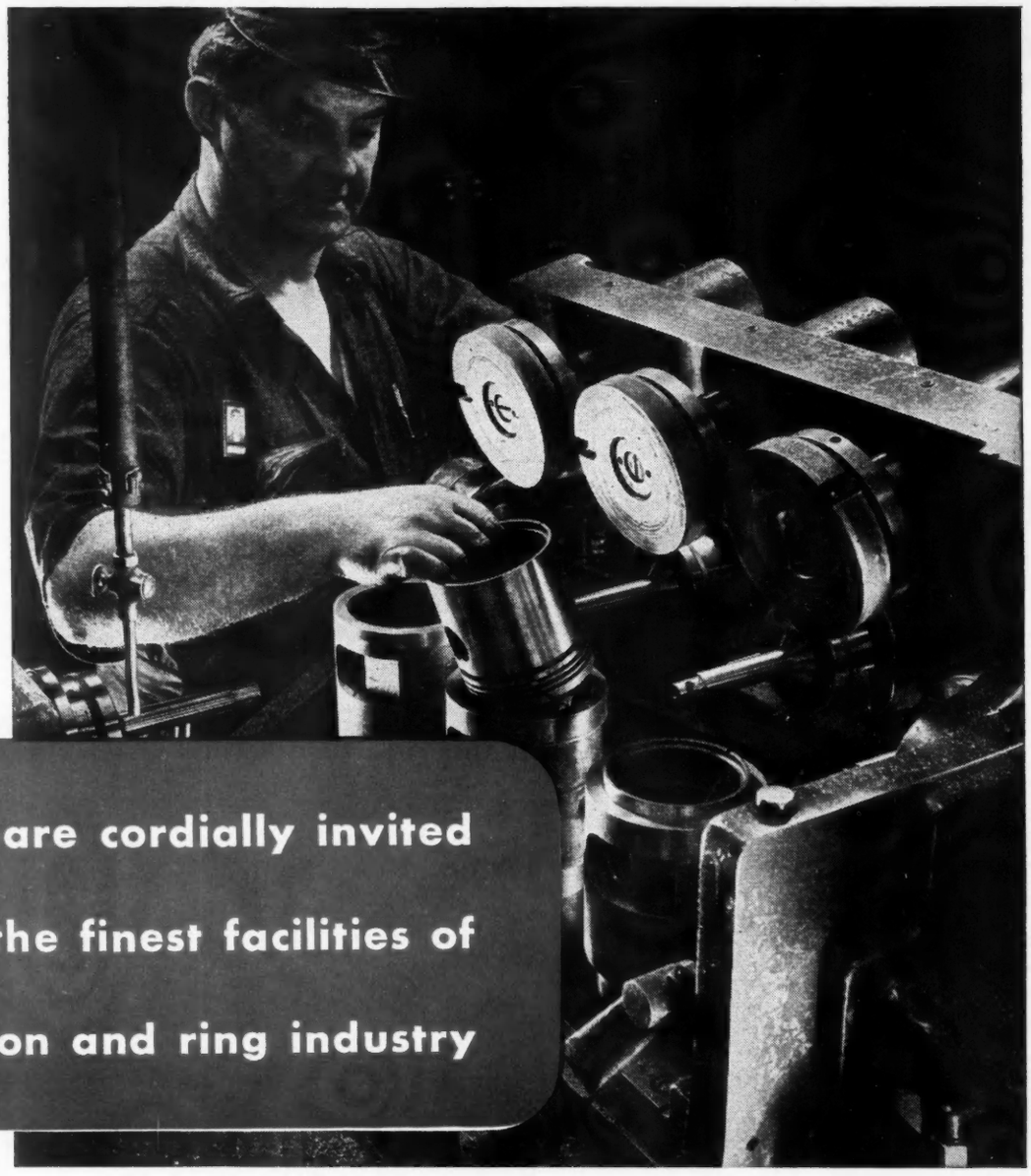
A look at the record for the last week in May shows why automotive production dropped about 20,000 units during that period and why the total output for the month of May showed a decline of about the same amount under April. Ford did not operate the final week, having been closed since the middle of the month. Studebaker and Nash also were out of the production lineup, with the former scheduled to reopen June 3, but with Nash to stay closed until at least June 10. Chrysler corporation plants closed on Wednesday for the holiday weekend, with the Dodge and DeSoto divisions scheduled to reopen on the following Monday and the Plymouth and Chrysler plants idle until Wednesday. General Motors production was curtailed by shortage of seat and back springs but started in hopefully again the following week. The important thing about the production record is that the trend was sharply downward during the last two weeks of the month, instead of climbing to a new peak as it did early in May. The present most critical bottlenecks are bumpers, bearings, and seat-cushion and back springs, although there are in addition a great number of other items in short supply.

Hints of New Wage Drive Come From Union Leaders

While current labor troubles holding up automobile production are centered largely in the supplier industries, some rumblings already are being heard from leaders of car manufacturing locals that a new wage drive is in the making. The rapidly increasing price level has organized labor uneasy, and if prices continue to soar, a new series of wage demands is inevitable, observers say. Walter Reuther, UAW-CIO head, already has proclaimed publicly that a demand for higher rates is under consideration. This raises an interesting point in connection with Ford and General Motors, since existing wage rates under the contracts run until May 30 and March 31 respectively. Consequently, any wage demands made now or in the near future would be in direct violation of the union's written contract. The Chrysler contract contains no provision barring reopening of the wage question, and it is expected that the first attack on existing wage structures will be made there.

Recent Car Price Increases Do Not Insure Profits

Despite the price increases of 4 to 8 per cent granted by OPA for new automobiles, the manufacturers do not stand to make any money at present levels of production. Most companies are wary about comment on this score, but a few spokesmen have indicated that their companies cannot possibly break even at current erratic production rates. They say that it will be many weeks before the supply lines will allow volume large enough to show a profit. At best the new prices will serve to cut down the substantial operating losses which all car manufacturers have suffered during the first two quarters of this year. The president of one large company stated in an interview recently that he did not think any company would make any money this year. "It looks," he said, "as though 1946 is going to be a very bad year for the automobile industry." When prices were given the latest boost, some comment developed about whether some buyers might not be driven out of the market. A check among Detroit's dealers, however, showed no significant indication that the higher prices have affected the demand for cars.



Diamond boring piston pin holes

You are cordially invited to use the finest facilities of the piston and ring industry

HERE in Muskegon Sealed Power has built up, over thirty-five years, a plant and a staff long recognized by automotive engineers as the finest in the industry. Today these facilities are more extensive than ever before. You are cordially invited to make full use of them to help make your good engines even better.

SEALED POWER CORPORATION

Muskegon, Michigan • Stratford, Ontario

Keep Your Savings Bonds! Get $4 for $3!

SEALED POWER PISTON RINGS

PISTONS — CYLINDER SLEEVES

Changes in Corporation Setup at General Motors

General Motors directors, at an organization meeting held June 3, authorized a modification of the organization structure of the Corporation as well as several important changes in official responsibilities.

Alfred P. Sloan, Jr., was re-elected chairman of the board of directors and C. E. Wilson president of the corporation. The president was designated as Chief Executive Officer of the Corporation in place of the chairman, as heretofore. The Policy Committee, which since 1937 has dealt with both financial and operating policies, will be divided into two committees—one dealing more specifically with financial policy and the other with operating policy. There will be no change in the responsibility of the Administration Committee, which will continue to deal with all the various phases of management. This committee will come under the jurisdiction of the Operations Policy Committee in place of the Policy Committee as heretofore. The members of the Administration Committee comprise executives directly in charge of the larger operations and others indirectly in charge of operations grouped together for purpose of administration.

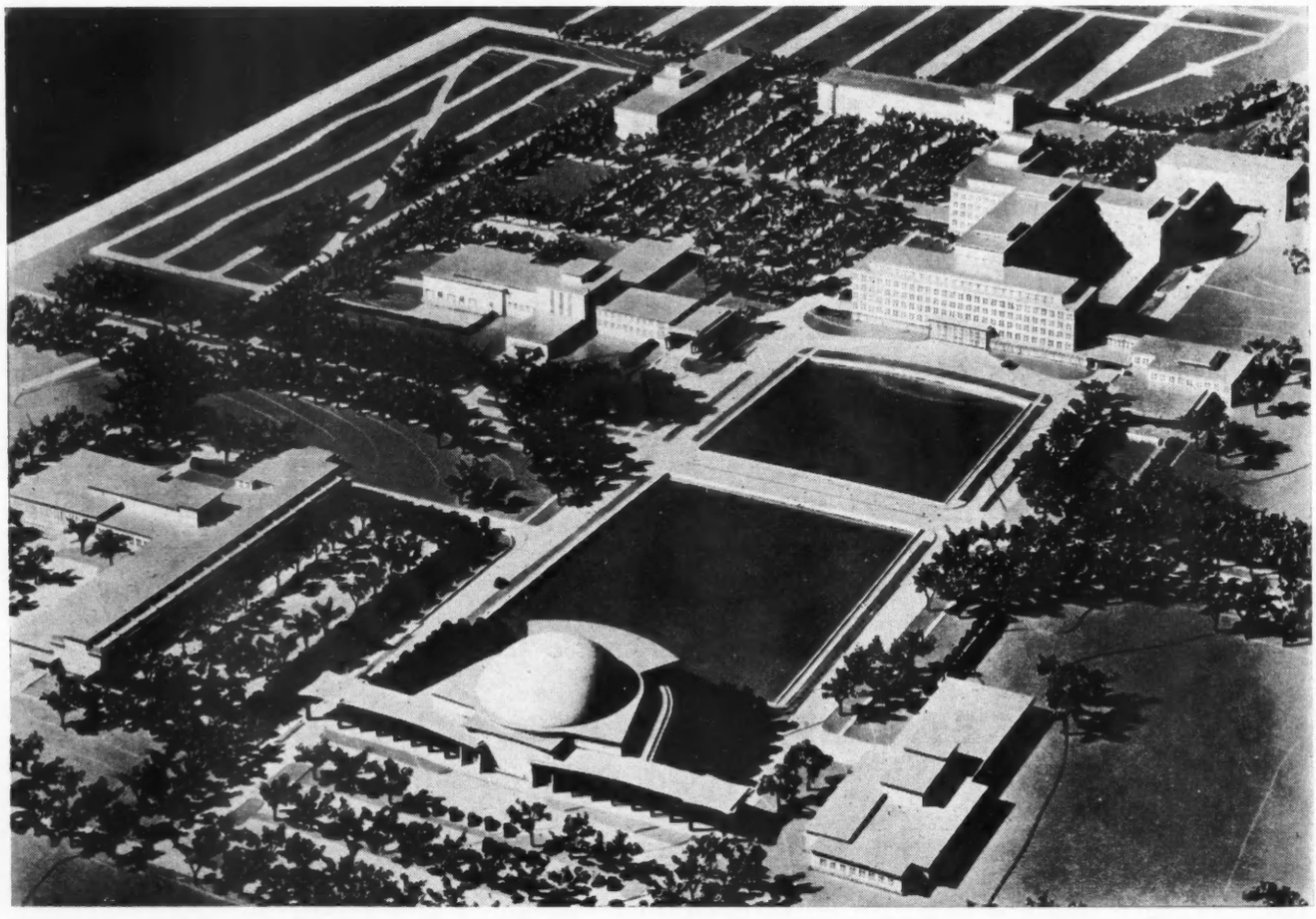
R. K. Evans and L. C. Goad were elected directors of the Corporation. The members of the existing Policy Committee were elected members of the Financial Policy Committee with the exception of C. E. Hunt, executive vice-president, who will serve the Corporation as a member of the Operations Policy Committee, and Lammot du Pont, who has retired. Albert Bradley, executive vice-president, was elected chairman of the Financial Policy Committee with headquarters in New York.

The purpose of the changes adopted by the directors today is threefold—first, to strengthen the general executive staff of the Corporation in view of its expanding responsibilities; second, to concentrate the administration of the operational affairs of the corporation in Detroit; and, third, to advance executives who have distinguished themselves during recent years and hence have demonstrated their ability to assume increased responsibilities.

Foy Now Board Chairman Of Jack & Heintz

Byron C. Foy, who was vice president of Chrysler Corporation from Oct. 1929 until his resignation May 15, 1946, is now chairman of the board of Jack & Heintz Precision Industries, Inc. William S. Jack is president of the company, which was formed in March of this year through a merger of Jack & Heintz, Inc., with Precision Products Corporation. Other officers of the company include: B. C. Milner, Jr., chairman of the executive committee; Ralph M. Heintz, vice president in charge of engineering; Edward R. Legg, executive vice president; A. A. Ricker, vice president; and W. R. Jack, vice president.

Proposed Research and Engineering Center for Ford Motor Company



Here is an architect's sketch of a new research and engineering center to be located at Dearborn, Mich., plans for which were announced by Henry Ford II, president of the Ford Motor Co. The project will take eight years to complete. It is estimated that the total cost in construction and equipment will be $50 million. It will be located on a 500-acre tract west of Dearborn Inn. The center will comprise a primary group of eight buildings and will bring into close geographical relationship all research, development and engineering activities for the company's Ford, Mercury and Lincoln divisions. These eight buildings will be grouped around an artificial lake 800 ft long and 350 ft wide. The buildings will be of modern design steel and concrete construction with limestone facings.

DESIGNING FOR DIE CASTING

TRIMMING

In designing die castings, it is important to remember that flash always occurs on castings at the die partings, and that steps can be taken in design to bring the flash where it can be trimmed most easily and quickly by a shaving die.

Cost of flash removal is minimized when:

1. *The die parting can be in a single plane.*
2. *Slides and movable cores are not required in the die.*
3. *Cores do not join or intersect in forming the casting.*
4. *Blind holes rather than through holes are employed.*
5. *Contours of the casting at the parting are of simple shape.*
6. *Flash occurs at points where other machining is required, in which case a separate flash removal operation is avoided.*

Flash which runs along a flat surface, and is not at the extreme edge of the casting, is difficult to remove cleanly without leaving tool marks on adjacent surfaces.

The designers of the above *zinc alloy* die cast coffee mill housing avoided this problem by merely employing decorative beads on either side of the casting at the parting line. Thus the flash occurs on the beads, from which it is easily shaved off without marking the surrounding areas.

Additional data on trimming and other design considerations appear in our booklet "Designing For Die Casting." To insure that you will get the most from your die casting dollar, ask us—or your die casting source—for a free copy of this booklet.

ZINC
FOR DIE CASTING ALLOYS

THE NEW JERSEY ZINC COMPANY • 160 Front St., New York 7, N. Y.

The Research was done, the Alloys were developed, and most Die Castings are based on
HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

Publications Available

Publications listed in this department are obtainable by subscribers through the Editorial Department of Automotive and Aviation Industries. In making requests give title above the item concerning the publication desired, the date of issue in which it appeared, your name and address, company connection and title.

Corrosion Control

The Dow Chemical Co., Magnesium Div.—13-page illustrated booklet dealing with the use of magnesium anodes for cathodic protection. Descriptive information regarding this method of corrosion control is presented along with answer to some of the more commonly asked questions concerning this subject.

Buda Jacks

The Buda Co.—Bulletin 1040D, describing and illustrating all the various models and types of ratchet, screw and hydraulic jacks manufactured by the company. Special features and specifications of the various models are included.

Hy-Draulic Planer

The Rockford Machine Tool Co.—The Rockford Hy-Draulic Open-side Planer is illustrated and described in a new bulletin. Facts about design, construction and operation are completely outlined. Detailed specifications of the Planer are given for all of the four rated sizes, each available with a choice of five different stroke lengths from ten feet to twenty feet. Bulletin number is 260.

Rotary Pumps

George D. Roper Corp.—Bulletin No. 10 describing and illustrating Series K Rotary Pumps. Construction features, specifications and performance data charts are included.

Dilecto Catalog

Continental - Diamond Fibre Co.—Catalog DO-46, prepared to acquaint engineers and designers in industry with the properties of Dilecto, a laminated phenolic plastic, its manufacture and its uses. A special feature of the catalog is a center spread consisting of an up-to-date comparative chart showing electrical and mechanical properties of Dilecto Sheet Grades.

Camographs

Air Reduction Sales Co.—A new bulletin describing Airco Camographs Nos. 4 and 5 oxyacetylene cutting machines. Included are specifications, operating instructions and electrical requirements. The bulletin is complete with illustrations of both machines and has color diagrams of their respective cutting ranges.

Ternalloy Aluminum Alloys

The National Smelting Co.—Ternalloy aluminum alloys, a series of aluminum-magnesium-zinc alloys possessing high elastic properties, are described in a new illustrated bulletin. Information is included on their aging characteristics, mechanical and physical properties as sand cast and chill cast, and chemical composition.

Rotex Pumps

H. K. Porter Co., Inc., Quimby Pump Div.—A new bulletin on Streamflow Rotex Pumps, rotary type, positive displacement pumps used for moderate or low viscosity liquids under medium pressure. The folder contains complete specifications, dimensions and performance charts.

Thur-Ma-Lox

The Dampney Co. of America—New bulletin giving the story of Thur-Ma-Lox coatings, for protection of metal surfaces in power and process equipment, what they do and how they are applied, with a list of typical applications for Numbers 7 and 10, with data sheets.

Tubing Specialties

Summerill Tubing Co.—New folder describing a wide variety of tubing specialties, including special accuracy tubing made to extra close tolerances; heat treated alloy tubing; Capillary tubing with .004 ID.

Pneumatic Tools

Keller Tool Co.—Catalog No. 12. Air tools and their practical on-the-job applications are illustrated and described. Capacity and specification tables are presented in easily understood form, together with ordering instructions for each tool. Fourteen new tools developed during the war are included, among these are an air powered sawing and filing tool, an impact wrench, etc.

Rear-Drive Kaiser Special

Manufacturing difficulties have delayed production of the Kaiser front-drive car until later this year, according to Henry J. Kaiser, chairman of the Kaiser-Frazer Corp. For the present, the company will build this Kaiser Special with rear-wheel drive. It employs a conventional frame with leaf springs at the rear and coil-spring front suspension. The engine is a 92-hp Continental.

Glidden Tour for Veteran Automobiles

The Veteran Motor Car Club of America has announced the First Annual Revival Glidden Tour to be held Aug. 17 to 24, 1946. One or more cars may be entered for the tour by any member in good standing of whatever classification of the Veteran Motor Car Club of America, the Horseless Carriage Club, or the Antique Automobile Club of America.

Cars up to and including 1919 may be entered. Inasmuch as the last Glidden Tour took place in 1913, members are urged to enter cars of the Glidden Tour era.

Officially, the Tour starts the morning of Sunday, Aug. 18, at Albany, N. Y. Participants should arrive in Albany on Saturday night, Aug. 17.

The first day's run is to Syracuse, N. Y.—about 140 miles. There will be a noon control stop for a picnic lunch. The exact town will be announced later. After a night in Syracuse, an early start will be made on Monday, Aug. 19 with Rochester, N. Y., as point of destination. The distance about 91 miles. There will be a half-way noon control point for lunch.

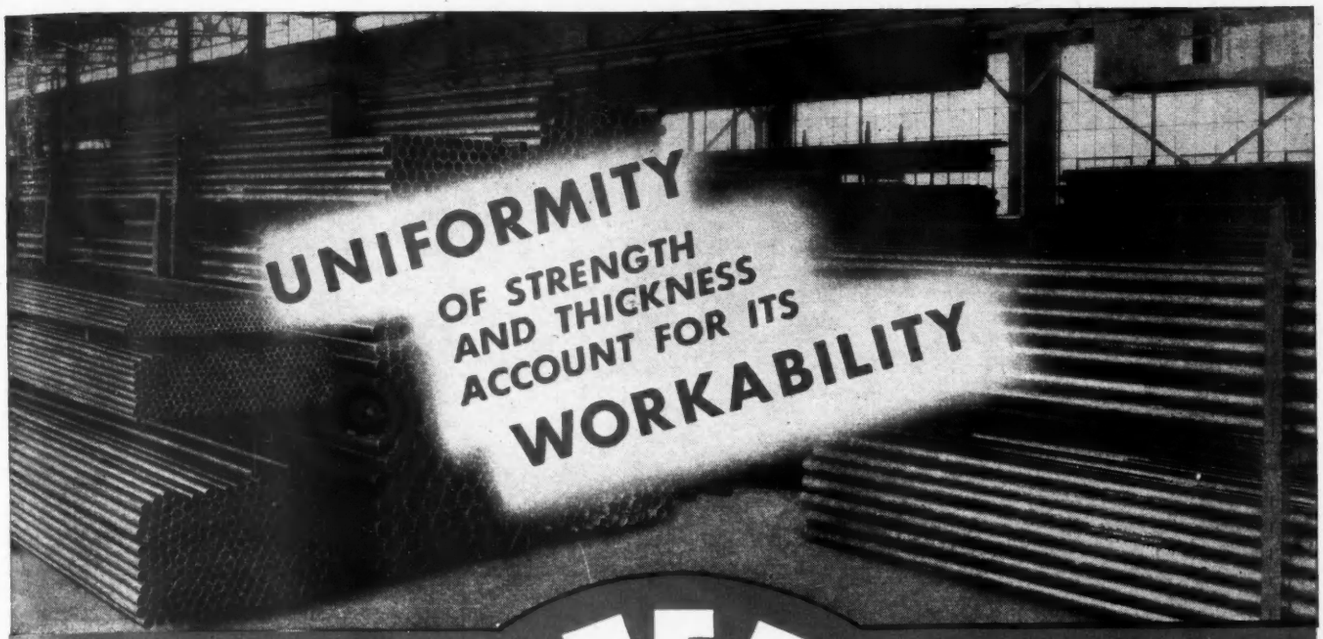
The Glidden Tour is resumed early Tuesday morning, Aug. 20, for the short 72 mile run into Buffalo. Arrival must be timed for 2 p.m. to catch the Buffalo to Detroit steamer. The boat leaves at 5 p.m. Eastern Standard Time, but time should be allowed for loading.

An early start will be made in Detroit on Wednesday morning, Aug. 21, for the short run to Dearborn, a distance of 20 miles. That day and part of the morning of Thursday, Aug. 22, will be spent in visiting the Ford Museum which includes a complete veteran car collection.

Thursday afternoon the calvacade will depart from Dearborn, to be guests at a dinner given by General Motors in Detroit. Participants will board the night boat to Cleveland which sails at 11 p.m. Boat must be boarded not later than 9 p.m. This will probably be the first night of driving.

On Friday morning, Aug. 23, tourists will drive to see Thompson Products' Antique Auto Museum in Cleveland. That night will be spent in Cleveland. On Saturday, Aug. 24, the last official

(*Turn to page 64, please*)



Michigan STEEL WELDED TUBING

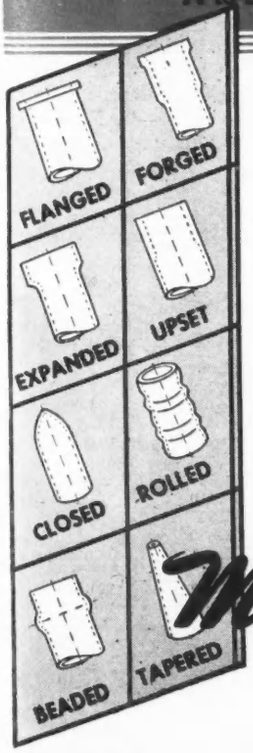
ALSO

SQUARE • RECTANGULAR

Minimum dimension ½"
Maximum dimension 2¼"
14 to 20 gauge.

ROUND

¼" to 4" O.D.
9 to 22 gauge



The "Production Parts Tubing"

Because it re-forms and machines so well, Michigan welded steel tubing is widely used in the fabrication of production parts such as automobile exhaust and muffler tail pipes, gas tank filler tubes, steering jackets, and wherever bent and shaped tubes may be required. True concentricity, uniform I. D. and O. D. make it particularly economical when long runs are involved.

Prefabricated Parts or Tubing

Michigan will furnish the complete part fabricated from welded steel tubing, all re-formed and machined. If you have the equipment and capacity in your own plant to do this work, consider Michigan as your source for tubing in the sizes listed above—commercial mill lengths or cut to special lengths.

Engineering advice and technical help in the selection of tubing best suited to your needs.

Michigan STEEL TUBE PRODUCTS CO.

More Than 25 Years in the Business

9450 BUFFALO ST. • DETROIT 12, MICHIGAN

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PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

The White Motor Co.—Coach Div., **Newton R. Collins,** Director of Purchasing and Material Control.

Willys-Overland Motors, Inc.—**R. T. Baldwin,** Asst. Sales Mgr.; **Russell L. Underwood,** Assistant to the General Sales Mgr.

Willys Export Corp.—**Harold D. Ferguson,** Special Representative to Brazil.

Fairchild Aircraft Div.—**Henry C. Billings,** Supervisor of Projects Control Group.

United States Rubber Co., **Dr. Sidney M. Cadwell,** Director of Research and Technical Development. **Harry E. Cooper,** Manager of Lastex Yarn and Rubber Thread Div.

Catalytic Engineering and Construction Co.—**Alan I. McCone,** Mgr. of Industrial Relations.

Eaton Mfg. Co.—**Robert F. Golden,** head of newly established Research and Development Dept.

Goodyear Aircraft Corp.—**Russell DeYoung,** Vice-Pres. and General Mgr.; **T. A. Knowles,** Vice-Pres. in chg. of Sales and **Dr. Karl Arnstein,** Vice-Pres. in chg. of Engineering and Design.

Firestone Tire and Rubber Co.—**William S. Wilson,** Asst. Manufacturer's Sales Mgr.

Young Radiator Co.—**W. H. Schmeling, A. D. Bogus, Edward C. Uecker** and **M. H. Canham,** sales engineers.

Jessop Steel Co.—**J. L. Klein,** Director of Research.

International Harvester Co., Motor Truck Div.—**W. K. Perkins,** Mgr. of Sales.

General Electric Co., Plastics Div.—**George P. Lehmann,** Asst. Manager.

Fram Corp.—**Harry K. Nagel,** Export Manager.

Midwest Body & Mfg. Div.—**Stewart Q. Larsen,** Chief Engineer.

Philco Corp. — **William Balderston,** elected Executive Vice-President.

The B. F. Goodrich Co.—**Ward Keener,** Vice-Pres. for Employe Relations.

The Parker Appliance Co.—**Robert H. Davies,** head of newly created Engineering Div. **Emmet C. Hartley,** Manager of new Special Products Div.

Buffalo Bolt Co.—**Raymond K. Albright,** Chairman of the Board; **Rudolph B. Flershem,** President; **Charles L. Turner,** Vice-Pres.; **John J. McLaughlin,** Vice-Pres.; **S. C. Wead,** Secretary and Treasurer; **Charles O. Cornell,** Comptroller; **Ralph B. Plumb,** Asst. Secretary and **J. E. Murphy,** Asst. Treas.

Chicago Pneumatic Tool Co., Diesel Engine Div.—**Robert A. Rankin,** Sales Manager.

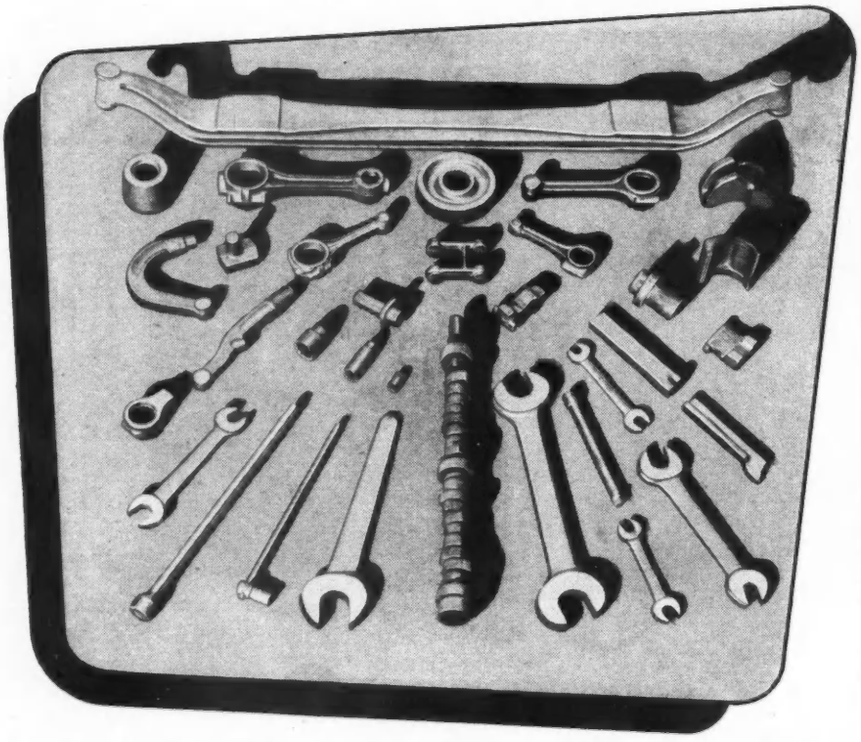
American Brake Shoe Co.—**J. F. Weller,** Sales Asst. to the President.

Washington Steel Corp.—**Arthur G. Buterbaugh,** Sales Manager.

Dravo Corp.—**Walter P. Berg.** General Mgr. of Machinery Div.

Universal Lubricating Systems, Inc. —**Austin L. Staley,** President and **William P. Farrell,** Vice-President.

Ladish Drop Forge Co.—**C. R. Standen,** Advertising Manager.



HERBRAND

PRECISION FORGINGS

--Any Shape or Size up to 200 lbs.

In this postwar period of high speed production—it pays to specify Herbrand, a source of quality forgings since 1881.

Herbrand provides the latest, most modern forging facilities including steam hammers, board hammers, forging machines, bending machines, heat treating and die making equipment . . . Our forgings possess an enduring, inbuilt stamina because they are scientifically heat treated by definite process in the latest automatically controlled furnaces.

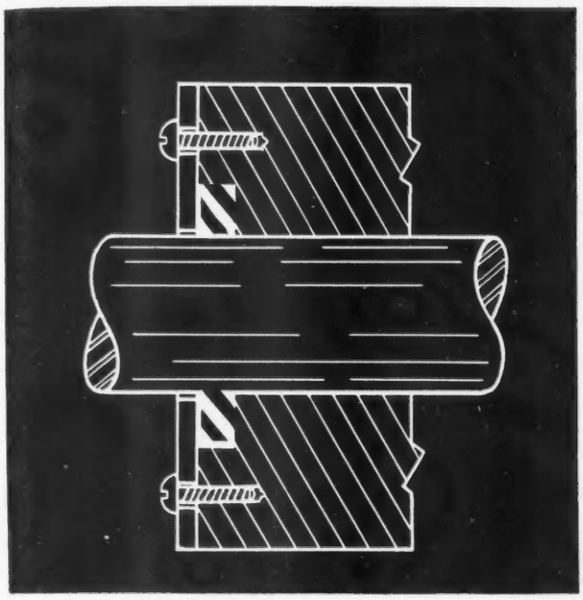
Exacting inspection by skilled men assure forgings free from defects . . . Your inquiries are solicited.

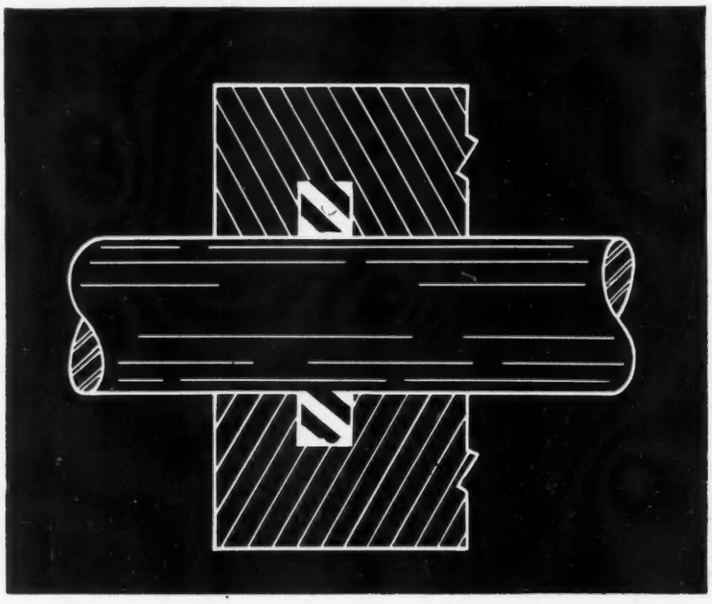
THE HERBRAND CORPORATION
FREMONT, OHIO

Weekly Production of Cars and Trucks in U.S. and Canada*

Week ending	1946	Corresponding Week in 1941
Jan 5.....	13,920	76,690
12.....	23,340	115,935
19.....	28,465	124,025
26.....	29,410	121,948
Feb. 2.....	29,295	124,400
9.....	23,785	127,675
16.....	21,555	127,510
23.....	19,410	127,740
Mar. 2.....	17,575	126,550
9.....	23,050	125,915
16.....	35,020	131,410
23.....	37,285	123,805
30.....	43,070	124,165
Apr. 6.....	47,735	116,255
13.....	49,425	99,260
20.....	57,565	99,945
27.....	64,620	108,165
May 4.....	67,060	130,610
11.....	71,335	132,380
18.....	48,565	127,255
25.....	53,020	133,560
June 1.....	31,895	106,395
8.....	43,325	133,645
Totals	879,725	2,765,238

*Compiled by Ward's Automotive Reports.





SEALING ROTATING PARTS

Factors favoring use of simple, compressible rings

A compressible ring, placed either in a counterbore or in a groove, offers an effective yet simple means of sealing rotating shafts. Properly designed and installed, such a ring is non-binding, non-scoring. It can be made comparatively small in cross section when space must be conserved. And since it does not depend for its effectiveness upon springs, fingers, or other mechanical parts, it is relatively low in cost.

Armstrong's Cork-and-Synthetic-Rubber Compositions make excellent ring-type seals. These compositions combine the oil resistance and strength of synthetic rubber with the true compressibility of cork. Under compression, each air-filled cell of cork acts, in effect, as a self-contained spring. Constant pressure is maintained against the shaft without extrusion of the sealing medium.

To insure radial compression when assembled, cork-and-synthetic-rubber rings normally are furnished with the I. D. 1/64" scant, the O. D. and the thickness 1/32" full. These allowances, however, are influenced by the size and speed of the shaft and by the pressures involved. Half-rings also can be supplied for use in split housings as illustrated above on the right.

While cork-and-synthetic-rubber compositions are high-friction materials, binding is easily prevented by applying oil, grease, or graphite to the ring. One lubrication lasts for the life of the seal. Lubricant can be applied either in your factory or ours.

Since minor design details often assume major importance when a sealing material is chosen, we suggest that you call in an Armstrong Gasket Engineer before you set up your sealing specifications. Behind his counsel are our 34 years of gasketing experience and our wide-range line of standardized sealing materials.

If you prefer, send us drawings and details of your application. We'll gladly give you unbiased recommendations. Either way, there's no obligation.

SEND FOR FREE BOOKLET

For specification and application data on Armstrong's more than 50 resilient sealing materials, send for a free copy of the latest edition of "Gaskets, Packings, and Seals," twelve pages of helpful information. Address Armstrong Cork Company, Gaskets and Packings Dept., 1506 Arch St., Lancaster, Pennsylvania.

ARMSTRONG'S
GASKETS · SEALS · PACKINGS

Cork Compositions • Cork-and-Synthetic-Rubber Compositions
Synthetic Rubber Compounds • Cork-and-Rubber Compositions
Fiber Sheet Packings • Rag Felt Papers • Natural Cork

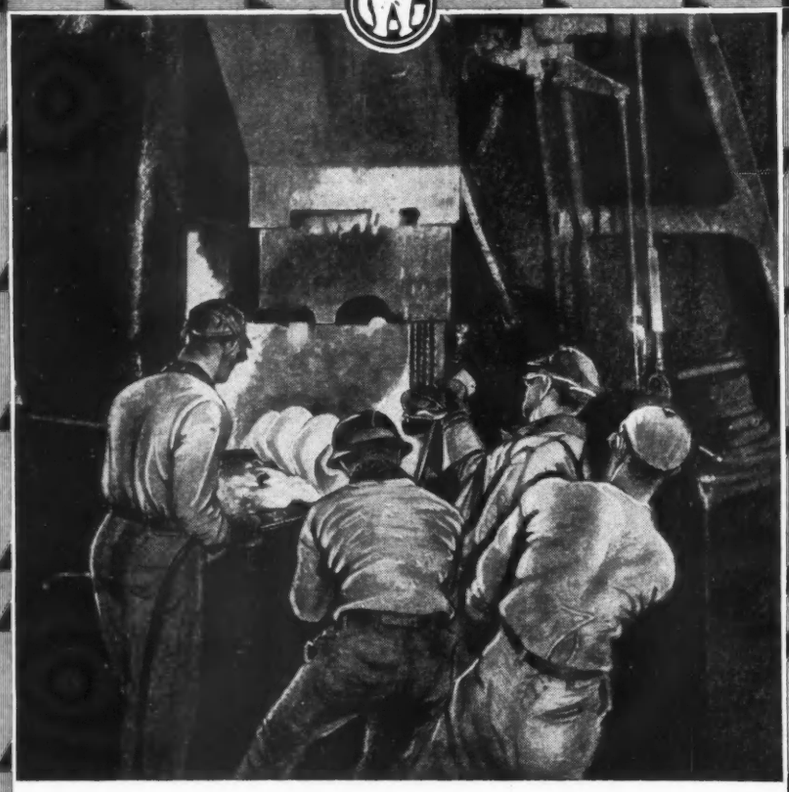
Unused Cars

These sedans have been waiting at the Anniston Ordnance Depot since April, 1943, to be put into use by the Army. Of the approximately 250 cars at the depot, only 16 have been declared Army surplus to be sold to veterans. Acme photo.

Strikes Holding Up Production at GM

As of May 20 there were a total of 143 different strikes that were stopping or delaying production in the plants of 33 General Motors units and suppliers. The units and suppliers affected and the number of strikes involved in each case are given in the following table:

Division	Number of Supplier Strikes
AC Spark Plug	13
Aeroproducts	5
Allison	4
Brown-Lipe-Chapin	3
Buick	10
Cadillac	17
Chevrolet	68
Cleveland Diesel	10
Delco Appliance	9
Delco Products	20
Delco Radio	11
Delco-Remy	20
Detroit Diesel	9
Detroit Transmission	2
Diesel Equipment	7
Electro-Motive	9
Fisher Body	17
Frigidaire	17
G.M. of Canada, Ltd.	18
GMC Truck & Coach Div.	23
Guide Lamp	9
Harrison Radiator	12
Hyatt Bearings	2
Inland Mfg.	6
McKinnon Industries, Ltd.	4
Moraine Products	2
New Departure	22
Oldsmobile	12
Packard Electric	8
Pontiac Motor Div.	12
Rochester Products	7
Saginaw Malleable	6
Saginaw Steering Gear	1
Total Current	394
Less: Duplications	251
Net Strikes	143



FOR highly stressed parts, it is an undisputed fact that there is no substitute for forgings. While high individual properties can be obtained by other methods of fabrication, the forging process still develops the greatest combination of physical properties (tensile and compressive strength, ductility, impact and fatigue strength) and the greatest uniformity of quality of any method of manufacturing metallic shapes. Forgings are still the ultimate in a combination of strength and toughness.

WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel

WORCESTER, MASSACHUSETTS, U. S. A.

HARVEY, ILLINOIS - DETROIT, MICHIGAN

CALENDAR

Conventions and Meetings

Amer. Soc. of Mechanical Eng.—Detroit June 17-20

Institute of the Aeronautical Sciences, Annual Summer Mtg., Los Angeles July 18-19

Municipal Airport Dedication & Sky Show, Mansfield, O. July 20-21

1st Annual Revival Glidden Tour, Albany, N. Y. ..... Aug. 17-24

SAE Natl. West Coast Trans. and Maint. Meeting, Seattle Aug. 22-24

Natl. Aeronautic Assoc. of Canada, International Air Show, Toronto Aug. 30-Sept. 7

Natl. Chemical Exposition, Chicago Sept. 9-13

SAE Natl. Tractor Meeting, Milwaukee, Wis. Sept. 11-12

Instrument Society of America, 1st Natl. Show, Pittsburgh Sept. 16-20

Natl. Aircraft Show, Cleveland Oct. 4-12

SAE Natl. Transportation and Maintenance Meeting, Chicago Oct. 16-17

SAE Natl. Fuels & Lubricants Mtg., Tulsa Nov. 7-8

American Welding Society Annual Meeting, Atlantic City Nov. 17-22

Natl. Metal Congress and Exposition, Atlantic City Nov. 18-22

SAE Natl. Air Transport Engineering Mtg., Chicago Dec. 2-4

Automotive Service Industries Show, Atlantic City Dec. 9-14

WHAT'S THE LIMIT?

The Empire State Building soaring almost a quarter mile into the New York sky-line, is the tallest building in the world. Can man build higher? One famous architect says, "Yes—twice as high!" What's the limit?

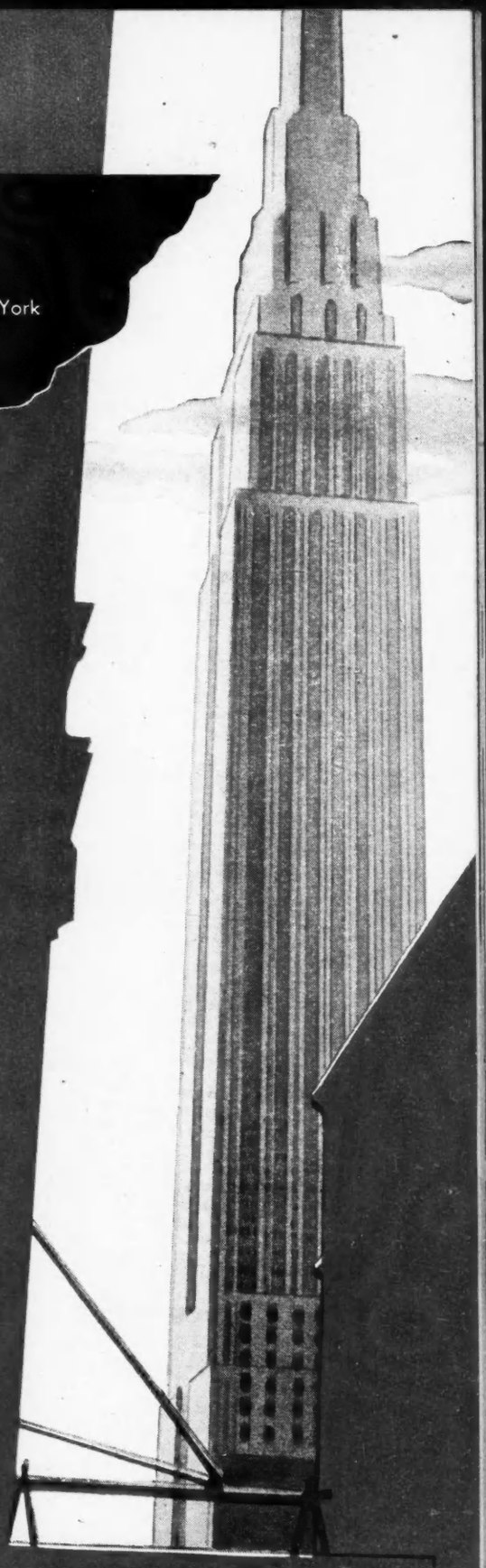
IS *Porous Chrome** THE ENGINE-LIFE PISTON RING?

We don't know yet, but 7,000,000 miles of grueling road tests indicate that possibility.

Porous Chrome piston ring sets, tested in all types of engine and all types of service, rolled up amazing records: ring life was multiplied four or five times—wear on the block was reduced by half—and because of a controlled honing action in the first hour's operation, the entire set of rings seated almost immediately, practically eliminating break-in wear.

Your American Hammered jobber is ready with Porous Chrome sets for bus and truck engines *now*. Wise fleet operators will call him without delay.

ANOTHER
American Hammered
RING LEADER



Chrome piston rings are an original American Hammered development

* Van der Horst process

Koppers Company, Inc., American Hammered Piston Ring Division, Baltimore, Maryland

American Hammered Piston Rings

A KOPPERS PRODUCT

Two Aircraft Shows To Be Held This Year

Two shows—all-inclusive of the aircraft industry—are to be held this year, the first in Cleveland, Oct. 4-12, and the other in Los Angeles during November, dates still to be determined. "Air power, air commerce and aircraft industry" will be thematic of both expositions, to be known as National Aircraft Shows.

Sponsor is the Aircraft Industries Association of America, Inc., embracing all components of the nation's aviation enterprises, as the name of the association indicates. Fabricators of all types of planes, the commercial airlines and military air services, together with engine and accessory manufacturers, will be represented at the exhibits.

The 1946 shows in Los Angeles and Cleveland will be but the first of such annual events, to be held in two representative cities to be selected yearly. Members of the association will not participate in any other unsanctioned exhibits.

Directly charged with arrangements for this year's National Aircraft Shows is Clyde M. Vandeburg, an executive of the N. W. Ayer & Son advertising agency at Philadelphia. He was granted leave of absence by that firm to direct the forthcoming air shows. At present he is a director of the Airpower League, headquartered in New York, as well as consultant to Aircraft Industries Association.

Fred Crawford, president, the Thompson Products Co. of Cleveland, has accepted the chairmanship of the National Aircraft Show in that city. He has been long and prominently associated with the aircraft industry. A chairman of the air show undertaking in Los Angeles will be selected at an early date.

- Buell Air Horns are tops in warning signal efficiency.
- Installed as original equipment on many Trucks and Buses.
- They reduce maintenance costs by decreasing stops, starts and slowdowns.
- All records prove that they save tires, brakes, clutches and gears.
- Cut gas and oil consumption.

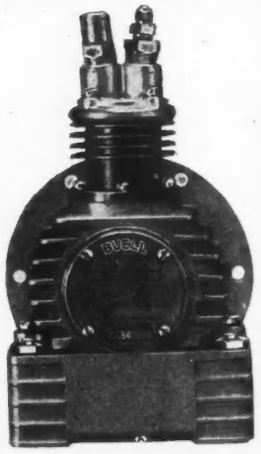
With a Buell the driver has greater security, maintaining a steady cruising speed. Slowing a 20 ton load from 50 MPH to 30 MPH means destroying a lot of energy thru brake lining and tires. It is replaced by burning more gasoline, increasing load on engine, and tires again, to regain speed. This all costs money. We believe a Buell Air Horn is worth $100.00 yearly on any heavy highway vehicle. Then remember a Buell will last more than 10 years. How would you rate a $100.00 investment that earned $100.00 yearly for 10 years. Ask the man who has a Buell.

BUELL AIR COMPRESSOR

- Used on Passenger Cars, Trucks, Buses, Boats and Planes.
- Small and compact in size . . . efficient and powerful in action.

Buell engine-driven compressors supplied air to operate air brakes in thousands of R.C.A.F. aircraft. Only a combination of quality and precision workmanship could meet the requirements of this type of service.

Designed for compactness and light weight, they are far more efficient and powerful than their size indicates. Let us prove their adaptability to your needs.



BUELL MANUFACTURING CO.
2975 Cottage Grove Ave., Chicago 16, Ill.

Bendix Aviation to Occupy Twice Its Prewar Space

Peacetime operations of Bendix Aviation Corp. will require almost twice the manufacturing space required before the war. By the close of the current fiscal year the corporation expects to own or have under lease 4,278,703 sq ft of space compared to 2,183,129 as of Dec. 31, 1939, and will then have the floor space and equipment needed to carry on operations projected in the corporation's postwar planning. At its wartime peak, Bendix was using 7,782,133 sq ft of space to turn out war goods which totaled $2,800,000,000 for the four fiscal years from Oct. 1, 1941 to Sept. 30, 1945. This was at the rate of $700 million a year compared to $40,311,110 of sales for 1939, the corporation's last peacetime year. Large British and French orders placed following the outbreak of war in Europe in the fall of 1939 required the corporation to substantially expand production even before America's defense program got under way.

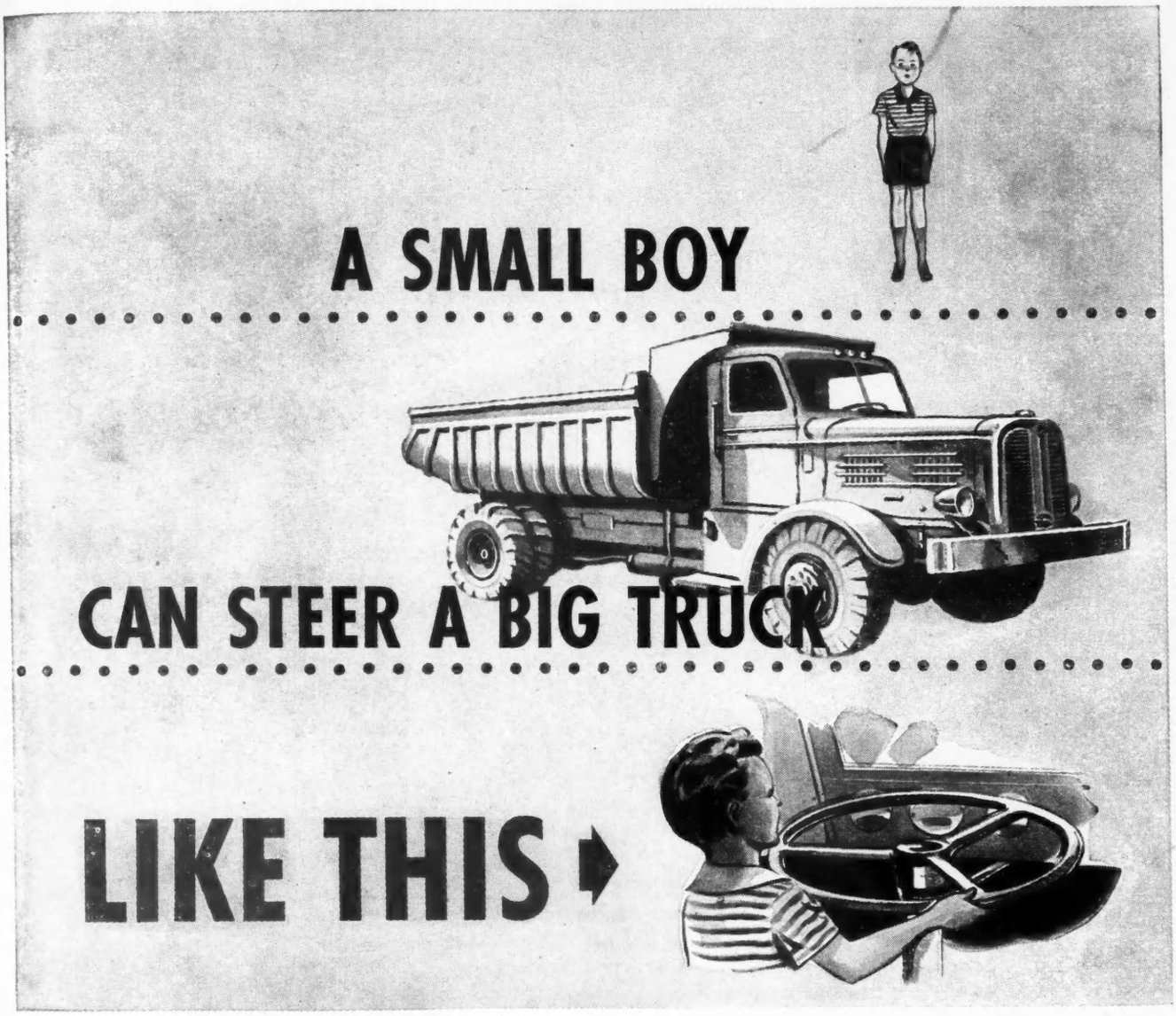
New Appointments for Dreystadt and Gordon

C. E. Wilson, president of General Motors, has announced the appointments of Nicholas Dreystadt as general manager of the Chevrolet Motor Division and of John F. Gordon to succeed Mr. Dreystadt as general manager of the Cadillac Motor Car Division. Mr. Dreystadt succeeds M. E. Coyle, who was elected an executive vice president of General Motors to devote his efforts to the general administration of the Corporation.

Glidden Tour

(*Continued from page* 58)

Glidden Tour day, tourists will drive from Cleveland to Columbiana, Ohio, a distance of about 60 miles. An early start from Cleveland will be made to reach Columbiana in time for lunch to be served by Harvey Firestone, Jr., on the family estate. Drivers will retire for the final night at neighboring Youngstown and head homeward on Sunday, Aug. 25.



with VICKERS Hydraulic POWER STEERING

We don't expect a small boy to drive a big truck, but his strength is many times equal to the steering effort required if the truck has Vickers Hydraulic Power Steering. The steering wheel turns with effortless ease, and the front wheels always follow *exactly*.

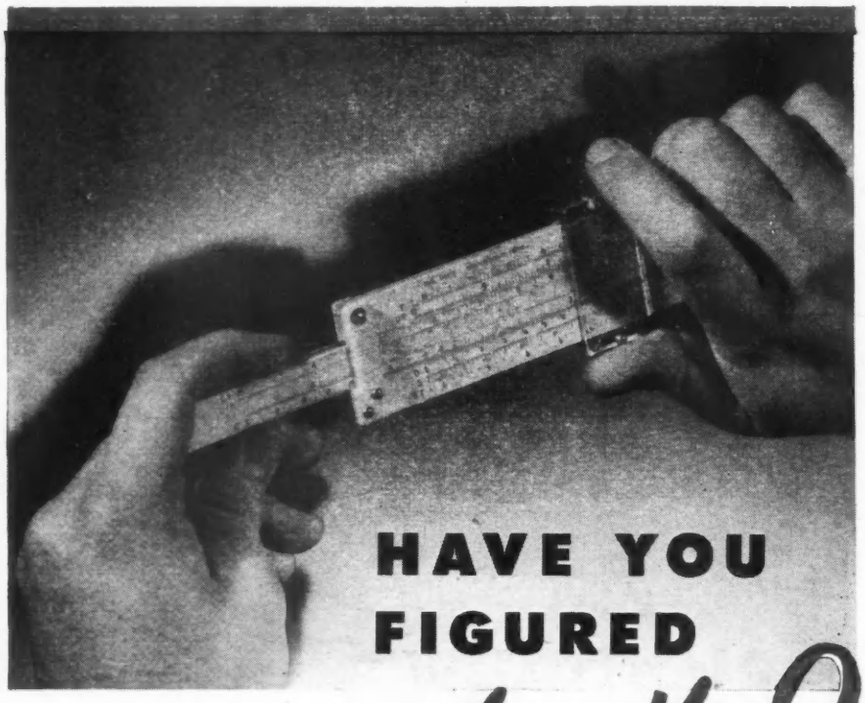
Moreover, no matter how rough the ground, no road shock can get to the driver. The steering wheel cannot spin, or jerk—the vehicle can be driven over the curb or through sand with no "fight" from the wheel. A flat tire will not cause swerving. The driver is relieved of the most fatiguing part of his job—enabling him to work faster and longer with greater safety.

Vickers Hydraulic Power Steering is simple, compact, easy to apply to existing chassis designs. It has automatic protection against abuse and excessive steering reaction forces. Lubrication is automatic. Fifteen years of successful operating experience on trucks, buses, road machinery, etc. have proved the value of Vickers Hydraulic Power Steering. Write for Bulletin 44-30.

VICKERS *Incorporated*

1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER



HAVE YOU FIGURED

Material handling?

PRODUCTION SKILLFULLY PLANNED, plant in tip-top shape, sources of supply secured —how about material handling—the vital factor in profit? Still using manual methods of yesteryear? *Use Clark Fork Trucks*—to lift, move and stack material. It's the time-saving, money-saving modern method, paced to the needs of current production.

Have a Tructractor Field Engineer study your needs—and engineer a plan to meet them.

CLARK

GAS and BATTERY POWERED FORK TRUCKS, PLATFORM TRUCKS, TOWING TRACTORS

CLARK TRUCTRACTOR
Division of CLARK EQUIPMENT COMPANY
BATTLE CREEK, MICHIGAN
OTHER PLANTS - BUCHANAN, JACKSON, BERRIEN SPRINGS, MICHIGAN

Products of CLARK • TRANSMISSIONS • ELECTRIC STEEL CASTINGS
AXLES FOR TRUCKS AND BUSES • AXLE HOUSINGS • BLIND RIVETS
INDUSTRIAL TRUCKS AND TRACTORS • HIGH-SPEED DRILLS AND REAMERS
METAL SPOKE WHEELS • GEARS AND FORGINGS • RAILWAY TRUCKS

NEW PRODUCTS

(*Continued from page* 52)

by Thompson Products, Inc. The new ring is designated U-Flex, which is derived from the U-shape of the segments which constitute its structure, and the flexibility characteristic of the ring.

A companion ring, the Z-Flex, also has been announced. The Z-Flex possesses features similar to those of the U-Flex, particularly in uniformity of radial wall pressure and in the control of oil.

The U-Flex is made of heat treated high carbon steel. Of simple, one-piece construction, it is designed to fit any piston without need for shims or expanders, and is interchangeable with any other oil ring. It features two rails, each composed of a number of U-segments. Each of the U-segments is separated from adjacent segments in the same rail by small gaps. Each of the U-segments is, however, connected to two corresponding U-segments in the opposite rail as shown in accompanying "magnifying glass" photograph which illustrates also the staggered relation of U-segments and gaps in one rail to those in the opposite rail.

When the ring is compressed to bore size, the segments are squeezed together, narrowing the gaps from approximately 0.008 to 0.001 in. Under this compression, each crossover acts like a coil of a spring, forcing the segments apart and against the cylinder wall.

It is apparent, therefore, that the free diameter of the U-Flex must be greater than the diameter of the bore in which it is installed. End gap is thereby eliminated, the ring ends butting firmly together when the ring is installed. However, effective gap is provided in the summation of all the small gaps.

Uniformity of wall pressure over its entire periphery is an inherent characteristic of the U-Flex. Because each crossover is identical to the next and has, as a consequence, the same spring rate, the pressure which each U-segment exerts against the cylinder wall is the same. It is said that through uniform wall pressure superior oil control is maintained, and bore wear is held to a minimum.

The U-Flex, through its flexible, live-spring action maintains uniform wall pressure not only in true cylinder bores but also in out-of-round, or taper-worn cylinders. Perfect contact is demonstrated in the exaggerated out-of-round sleeve pictured.

The U-Flex controls the supply of oil to the compression rings by means of the small gaps between the U-segments. These gaps allow tiny, parallel tracks of oil to remain on the cylinder walls, and are, in effect, metering orifices supplying the optimum amount of oil to the compression rings. The

(*Turn to page* 68, *please*)

PERMANENT RESILIENCE

Resilient parts made from HYCAR synthetic rubber *stay* resilient. That's partly because of HYCAR's unusual chemical stability—its resistance to oil and gas, acids and most other chemicals. And parts made from HYCAR are extremely resistant to the effects of oxidation, sunlight, and normal aging. A HYCAR sealing ring, for example, will maintain a positive seal through years of service even when constantly exposed to oils and acids inside the pipe, and sunlight and salt air outside.

Other unusual and valuable properties are listed in the box at the right. But most important, these properties may be had in an almost limitless number of combinations, each designed to meet the specific service conditions of the finished part. Parts made from HYCAR have seen service in *every* industry, giving long life, dependability, and economical operation.

That's why we say ask your supplier for parts made from HYCAR. Test them in your own applications, difficult or routine. You'll learn for yourself that it's wise to use HYCAR for long-time, dependable performance. For more information, please write Dept. HH-6, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. *EXTREME OIL RESISTANCE — insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY—down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATELY PRODUCED BUTADIENE TYPE

Synthetic Rubber

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

amount of oil to be passed and the wall pressure to be developed can be predetermined by regulating the size of the gaps and the free diameter of the ring.

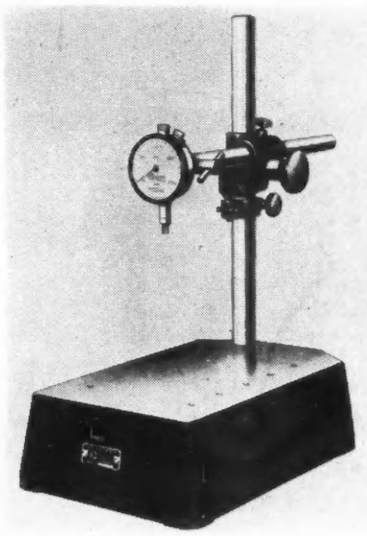
The unusually generous oil drain area of the U-Flex is more than adequate to drain away excess oil through the oil groove holes to the crankcase. In addition, carbon deposits must nearly fill the deep, open channel between the rails before fouling of the oil drain area can occur.

Dial Comparator

A new dial comparator model, designated as No. 107, is now in production at Standard Gage Co., Poughkeepsie, N. Y. It is said to be suited to a wide variety of uses due to the extensible indicator support arm and the tapped holes in the platen for securing the work. Any dial indicator having a standard AGD lug type back may be used.

By means of a double clamp arrangement the indicator support arm may be slid up or down on the vertical column, swung to any angle in either a horizontal or vertical plane, and moved to place the indicator at the desired distance from the column. Setting is facilitated by a vernier screw. A friction washer concealed in the swivel prevents the indicator arm from dropping unintentionally when the clamp is loosened for adjustment.

Working area of the platen is six in. by nine in. Five tapped holes on either side are spaced 1½ in. and will receive ¼ in.-20 bolts for securing the piece being checked.



Dial comparator model No. 107

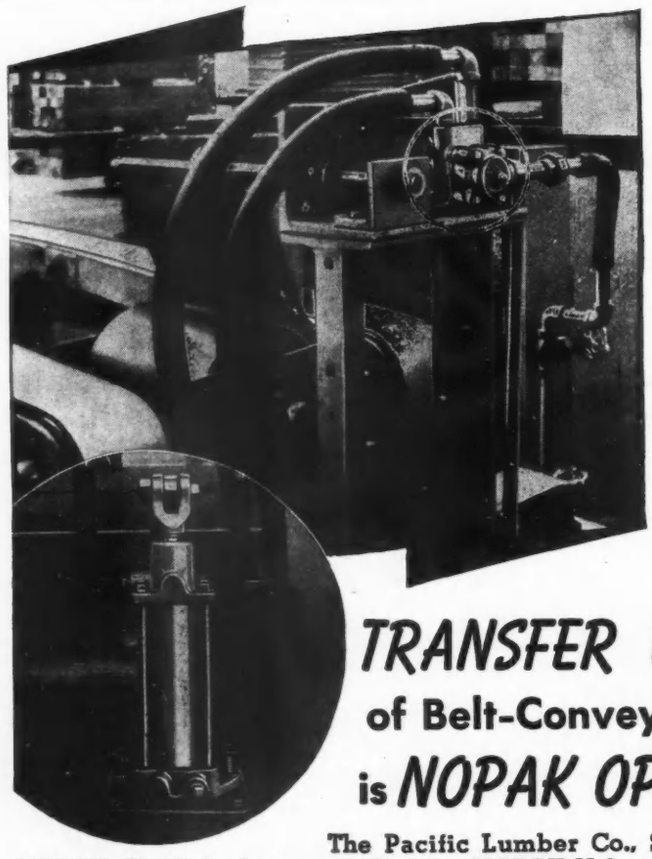
Power Shift Control for Two-Speed Axles

Physical driving aid to operators of heavy trucks equipped with two-speed axles is now available in the form of a small vacuum chamber which does the work of shifting the axle gears from low to high, or high to low, in conjunction with any regular transmission gear with a flick of the finger; according to Bendix Products Division, Bendix Aviation Corp., South Bend, Ind.

Known as the Bendix pre-selector power control, the conventional installation consists of a single or double line control vacuum power unit mounted on the rear axle housing, with

(*Turn to page 72, please*)

Control center of the Bendix power shifting mechanism



A Model R, NOPAK Foot Valve, with foot pedal replaced by cam and lever arrangement, is operated by impact of boards against kick plate.

NOPAK Model C Air Cylinder raises conveyor belt into position to carry lumber away at right angles to first conveyor.

TRANSFER CORNER of Belt-Conveyor System is NOPAK OPERATED

The Pacific Lumber Co., Scotia, Cal. uses NOPAK Air Cylinders, controlled by NOPAK Valves, for manual and automatic actuation of many units of its extensive conveyor system.

The "transfer corner" pictured is a typical example. As the boards come down the first conveyor belt, they run into a "kick plate" connected to the valve lever by cams and rods. The impact of the boards against the plate operates the valve, actuating the cylinder, which raises the twin conveyor belts above the level of the first belt, to carry the boards off at right angles for further processing.

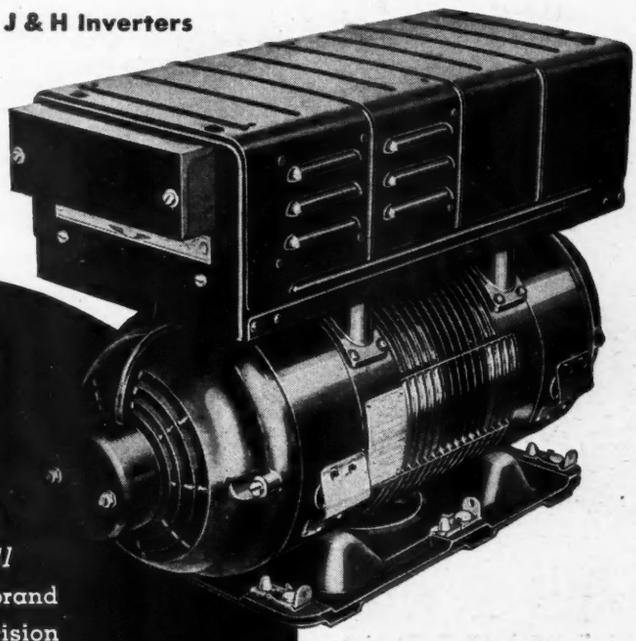
NOPAK Cylinders operated by Air or Fluid Power, and controlled by NOPAK Valves, are serving in hundreds of material-handling, pulling, pushing, lifting and holding operations . . . in all types of industry. Ask your nearest NOPAK representative for suggestions or write for Illustrated Bulletins.

GALLAND-HENNING MFG. CO.
2774 S. 31st Street
Milwaukee 7, Wis.

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE
A 4808-½I-R2-A

J & H Electronic Gages

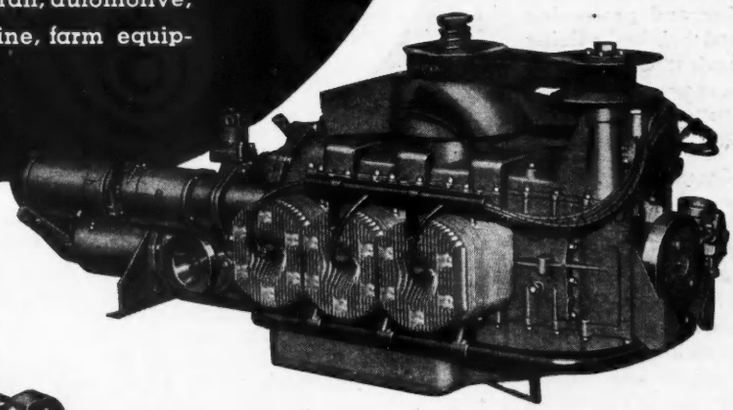
J & H Inverters

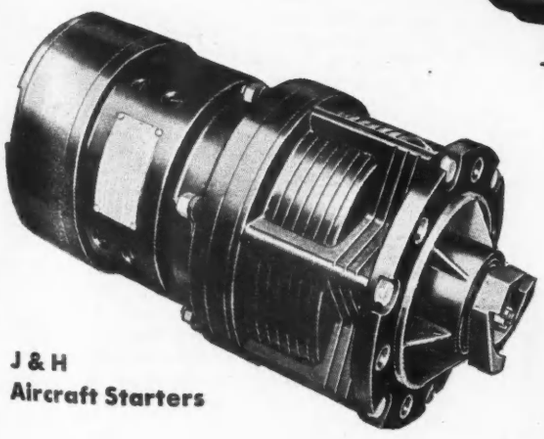


"Precision" is the new word that has been added to our logotype, but *Precision* is not new on our production lines. Our new name had its origin in these production lines where *skill in quantity* and *precision in volume* set brand new standards for the manufacture of high precision production parts.

Yes, the word "Precision" is now in our name. "Precision" is guaranteed by the skilled Jack & Heintz associates on our production lines. And you'll find precision performance in all of these Jack & Heintz products...built precisely for the aircraft, automotive, machine tool, home appliance, marine, farm equipment and transportation industries.

J & H Engines





J & H
Aircraft Starters

Jack & Heintz
PRECISION INDUSTRIES INC.
JAHCO
Cleveland 1, Ohio

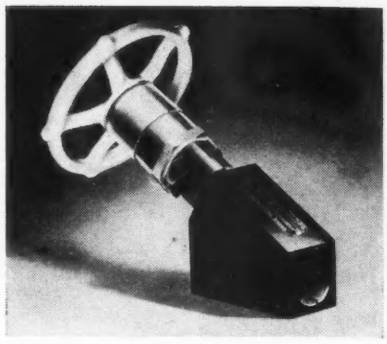
its operating rod connected to the high-low axle shift mechanism. This power cylinder is of ample size for an instantaneous response which makes the change action fast and accurate.

The vacuum line or lines are connected to the pre-selector control valve with its "high-low" gear selector lever, and a line to the vacuum source such as the engine manifold or vacuum pump.

With this new device the operator has at his fingertips double the number of gear combinations that can be obtained with the transmission alone, and they may all be used without physical effort other than moving the gear selector lever with one finger and then releasing the foot accelerator or disengaging the clutch, depending upon the type of installation.

Thirty Degree Globe Valve

The Series V and VL valves have just been introduced by Grove Regulator Co., 65 and Hollis Sts., Oakland, Cal. Extreme 30-deg valve body design in the globe pattern effects a minimum change in the direction of flow through the valve. Likewise, turbulence is said to be almost entirely eliminated, as the flow stream is carried through the valve in the direction of closing. Expansion takes place directly into the downstream line after the flow has passed through the valve.



Grove valve

A solid one-peice stem and plug is employed to effect tight shut-off when closed. The valve stem is not directly carried by the handwheel, which removes any chance of the stem becoming distorted or bent. All shocks are absorbed by a multiple full threaded section of the handwheel and yoke. All threaded surfaces and operating parts are protected by an encasing cap shield.

Essential operating parts of the valves are provided constant lubrication by a special factory-sealed process. The sealed lubricant is "zoned" entirely away from the flow stream and isolated from temperature effects.

This new design in 30 deg Globe and 90 deg angle pattern is provided in "Fullstream" quick opening shut-off valves; "Microstream" throttling valves; "Coldstream" shut-off valves; internal and external check valves; and strainers.

Glass Fiber Retainer Mats for Storage Batteries

Glass fiber retainer mats — thin diaphragms or filter screens for enclosing the positive plates of acid type storage batteries—are now being produced by John-Manville, 22 E. 40th St., New York 16, N. Y.

These glass retainers hold any migrant granular particles of lead in the facial interstices of the glass fibers, from which they may be restored safe-

(*Turn to page 74, please*)

Solid Carbide Drills

A complete line of solid carbide drills is now being manufactured by Willey's Carbide Tool Co., 1340 W. Vernon Highway, Detroit 1, Mich. The drills, of solid Willey's metal are said to give exceptional efficiency in drilling cast iron, brass, bronze, magnesium alloys, aluminum and non-metallic materials. Diameters range from 1/16 in. to ½ in., and lengths from 2½ in. to 6 in.

CHECK YOUR

BRAKE LINING REQUIREMENTS WITH GRIZZLY

REG U S PAT OFF

For over 30 years, leading production, engineering and purchasing men have checked their brake lining requirements against Grizzly's resources—and here are just a few of these requirements that Grizzly has successfully fulfilled.

✓ *Substantial Manufacturing Experience.* Grizzly has manufactured fine brake lining for both automotive and industrial fields for over three decades. ✓ *Adequate Production.* Grizzly maintains two large capacity plants employing the most modern mass production techniques. ✓ *Dependability.* Grizzly is one of the largest producers of molded brake lining and has long been recognized as a dependable supply source for brake lining of uniformly high quality. ✓ *Ability To Cope With Specific Brake Lining Problems.* Large but flexible; experienced but alert—those factors plus Grizzly's constant research and study of new brake lining developments enable Grizzly to solve brake lining problems of widely divergent natures.

✓ *High Quality Product.* Grizzly brake lining is engineered to provide all around superior braking performance under all conditions of service. It is an exclusive asbestos-friction compound, molded on a strong wire grid back, and it maintains a constant high coefficient of friction throughout longer life.

GRIZZLY MANUFACTURING COMPANY
PAULDING, OHIO
PLANTS AT PAULDING AND BELL, CALIF.
Warehouse Stocks in Principal Cities

"If we'd made this radiograph sooner...

...we'd have saved $30,000"

A manufacturer of valves, whose foundry technic seemed "okay," decided pilot radiographs weren't needed. But when machining was done and the valves assembled, enough were found defective to cause a loss of many thousands of dollars.

Radiography, put to work at the right time and place, pays off. Men who have figured *cost-wise* what it can do for them . . . to improve design, speed production, and lower costs . . . make full use of x-ray.

Radiographs show your engineers where to correct faulty design . . . how to reduce weight safely . . . how to cut costs at many stages of manufacture . . . how to build in extra dependability.

Order-jammed foundries get a welcome production spurt when radiography shows how to get into sound casting production fast. High-value, high-volume machine shops operate at rock-bottom cost when radiographic inspection keeps internally unsound castings off the production line.

Welding gains acceptance . . . new markets . . . higher volume . . . because radiographs prove weldments sound.

And these are only a few high spots in radiography's list of industrial functions. You can find more—if you look for them—right in your own plant. Why not get together with your radiographer or the local x-ray dealer and see if you are missing any chances to make radiography pay extra dividends? Or write to

Eastman Kodak Company, X-ray Division
Rochester 4, New York

Radiography —another important function of photography

Kodak

ly onto the positive plate surface when the battery is charged. Such minute lead oxide particles freed from the positive plate would otherwise drop into the sediment chambers, or might possibly contribute to the formation of a metallic short between plates and shorten the life of the battery. These retainers, nevertheless, permit practically unobstructed passage of electrolyte.

There are thousands of long continuous fiber filaments in every one of the many layers which combine to make up each mat. This built-up film is lightly impregnated with an acid-resistant phenolic type resin and completely oven-cured.

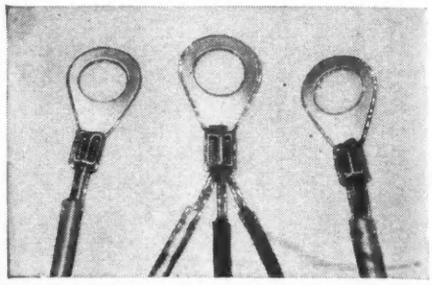
Thicknesses of 10, 20, 30, and 40 mils are standard for storage battery use but special thicknesses are available from 5 mils to 100 mils for special industrial purposes.

Terminals for Solid Wire

Aircraft-Marine Products, Inc., 1591 G No. 4 St., Harrisburg, Pa., has developed both the installation tools and terminals for attaching solderless connections to solid wire, or a combination of solid and stranded wire, or stranded wire.

The mechanical connection made by the AMP crimping operation is said to withstand vibration and torsional twist, overcoming the usual rigidity difficulties encountered in solid wire applications.

The conformation of the AMP crimp for solid wire is such that no air space exists inside the terminal, making full



AMP terminals

surface area contact with the conductor. The crimped shape definitely locates the solid conductor in a central position in the terminal barrel.

AMP terminals used in the application are all copper, hot electro-tinned for maximum electrical conductivity. These terminals have a short barrel, and when crimped there is no spreading of the terminal barrel. AMP terminals and installation tools are available for wire sizes 22 to 10 inclusive.

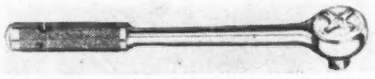
Sturtevant Sensory Torque Wrenches

The P. A. Sturtevant Co. of Addison, Ill., announces the addition of four new models to its Sensory line of torque wrenches. They are as follows: Model S200 having capacity of 0 to 200 lb-ft, calibrated in 5 lb-ft steps; Model S300 having capacity of 0 to 300 lb-ft, calibrated in 10 lb-ft steps; Model S2400-I having capacity of 0 to 2400 lb-in., calibrated in 50 lb-in. steps; and Model S3600-I having capacity of 0 to 3600 lb-in., calibrated in 100 lb-in. steps. These four Models are equipped with ¾-in. drive squares.

Up to now, the Sturtevant Sensory line has been furnished in 25, 50, 100 lb-ft and corresponding lb-in. capacities.

New Duro Wrenches In Three Sizes

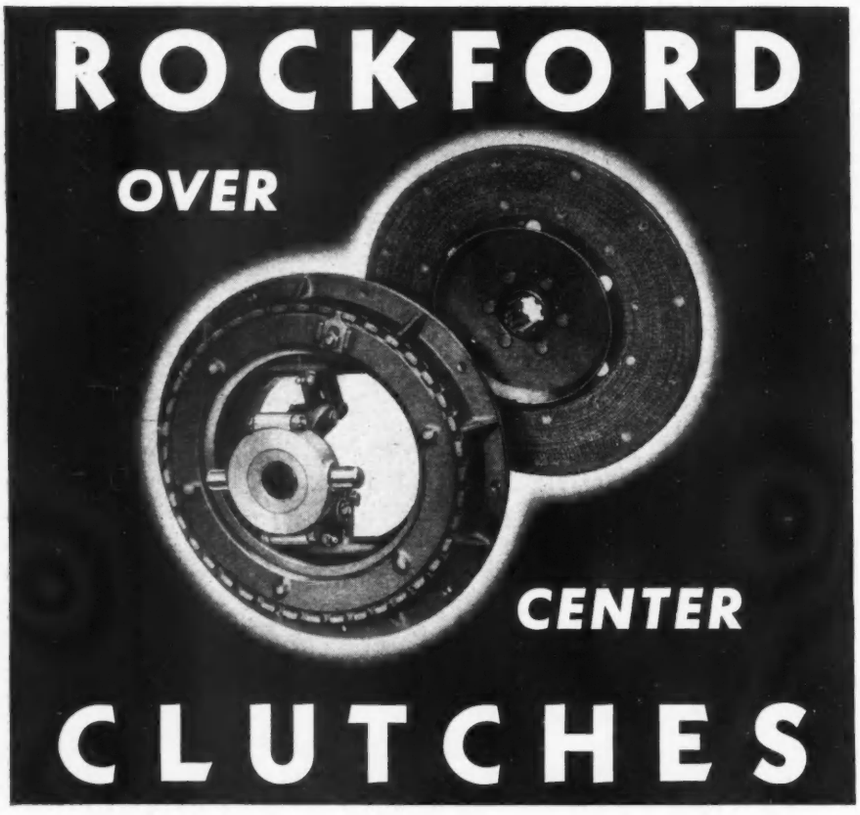
Duro Metal Products Co., Chicago, offers an 80-tooth-action Duro-Chrome ratchet wrench line with mechanism



Duro ratchet wrench

encased in a head measuring only ¾ in. by 1¾ in. According to the manufacturer, these new wrenches get action in arcs of less than five deg.

(*Turn to page 76, please*)



EASY OPERATION
HIGH TORQUE
POSITIVE ENGAGEMENT
LARGE DRIVING AREA
SMOOTH RUNNING
INFREQUENT ADJUSTMENT
MINIMUM INERTIA

* ROCKFORD Over-Center CLUTCHES are carefully balanced to prevent drag or centrifugal force from affecting their smooth running operation. An electronic gauge accurately checks the * balance of each ROCKFORD Over-Center CLUTCH, within extremely close limits, before it passes final inspection.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
315 Catherine Street, Rockford, Illinois, U.S.A.

A few of many bellows assemblies made to customer's specifications—ready to be fitted bodily into product designs.

HOW A BELLOWS CAN BEST IMPROVE YOUR PRODUCT

Fulton Sylphon bellows and bellows assemblies are subjected to careful tests before shipment. In the photo above the operator is "weighing" a bellows. Bellows must compress a specified distance and then spring back to normal length or it is rejected.

If your product can be built better with a bellows . . . and thousands of devices for industry and the home can . . . then insure *peak* performance by purchasing the complete bellows assembly from the original bellows manufacturer.

This is particularly important if the bellows assembly is to serve as a thermostat. For one thing, the filling, sealing and calibration must be carefully executed to produce a precision instrument. For another, the production of reliable assemblies requires trained personnel and special equipment . . . both expensive.

Since 1904, The Fulton Sylphon Company has specialized in this work. An extensive engineering organization and highly trained mechanics, maintained in a plant adequately equipped with precision machines, offer customers and prospects a complete designing, experimenting, testing and producing service.

For complete information, applications and helpful ideas, write for catalog LB-1300 today.

FULTON SYLPHON

Temperature Controls • Bellows • Bellows Assemblies

THE FULTON SYLPHON COMPANY • KNOXVILLE 4, TENNESSEE

Canadian Representatives, Darling Brothers, Montreal

In the new Duro-Chrome wrenches, the drive sizes are ¼ in., ½ in. and ⅜ in. In each size the proportioning of the tool differs, and in each the point of balance comes at the place where the tool "feels best" in the hand. Finish is triple chrome plate.

Hardened steel is used throughout the new Duro-Chrome line. The manufacturer advises that in breakdown tests, failure from overload occurs in the tang, not in the internal mechanism, and an overload is easily foreseen because the tang cannot shear until the handle has been bent two in.

Equipment for Loading Pressure Lubrication Guns

Loading of hand guns for pressure lubrication systems is said to have been resolved into a simple, clean, quick operation by new equipment just announced by the Alemite division of Stewart-Warner Corp., 1876 Diversey Pkwy., Chicago 14, Ill.

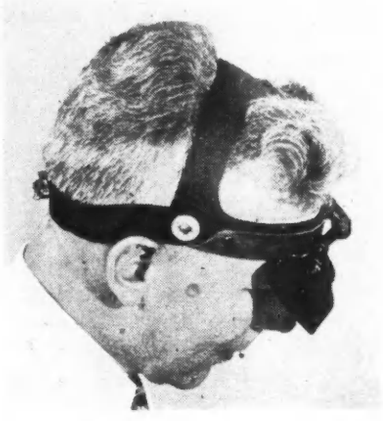
The new method eliminates disassembly of the hand gun, precludes danger of lubricant contamination or waste, eliminates annoyance of air pockets in the gun and permits gun loading in a few seconds.

A new "gun-loader fitting" which is mounted on the head of a hand gun and permits grease to flow into the grease reservoir of the gun in the same manner that it flows into a bearing through a lubrication fitting in normal lubrication, is the key innovation of the new gun-loading system. A loader valve mounted on a bucket pump or loader pump, functioning in the same manner that a coupler does when applied to a fitting, is the companion item to the loader fitting on the hand gun.

While several hand guns, both push-type and lever-type, as well as loader pumps of 25, 35, 100 and 400 lb capacity, all equipped with the special fittings and facilities required by the new gun loading system, were announced as ready, users of guns and bucket pumps already in the field can convert their equipment to the new system.

Super Sight Headloupe

A new "Super Sight" headloupe Model 502, supplied with a lens system in either of two powers, has been designed by the Boyer-Campbell Co., 6540 St. Antoine Street, Detroit 2, Mich., which supplements portable and



Super Sight headloupe model 502

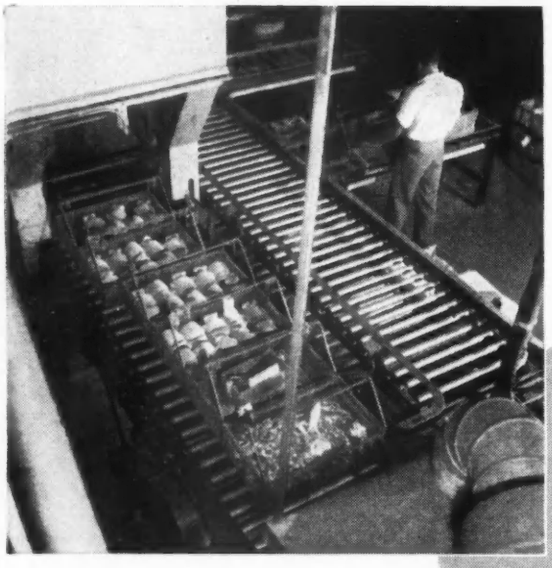
stand models of "Super Sight" that have been in use for several years. Worn with or without glasses, it is supplied with a bracket permitting the lens system to be set in any position for ease of the operator. The flexibility of the mounting permits lens holder to be moved in or out, up or down. It is easily pushed up out of vision when not needed.

Spring-Locking Fastener

The Lion fastener, a locking device for removable plastic, plywood, or metal strips, channels, housings or panels, has been placed on the market by Lion Fastener, Inc., Main St. East, Honeoye Falls, N. Y. It consists of two parts—stud and cantilever spring assembly. The stud is of one-piece construction with shoulders forged in opposite sides. Studs are available with

(*Turn to page* 80, *please*)

PERM-A-CLOR WHIPS THE TOUGH DEGREASING JOBS



...AND TRIAD HANDLES THE AVERAGE

For years, metal fabricators have turned to PERM-A-CLOR when their production flow clogged in the cleaning department.

Today, more than ever before, they are PERM-A-CLOR-minded when they buy.

They specify a reputation-backed, breakdown-resistant solvent that has been used successfully on thousands of grueling vapor-degreasing applications—aluminum, die castings, mixed metals.

For average degreasing requirements they pick TRIAD—a second Detrex Solvent.

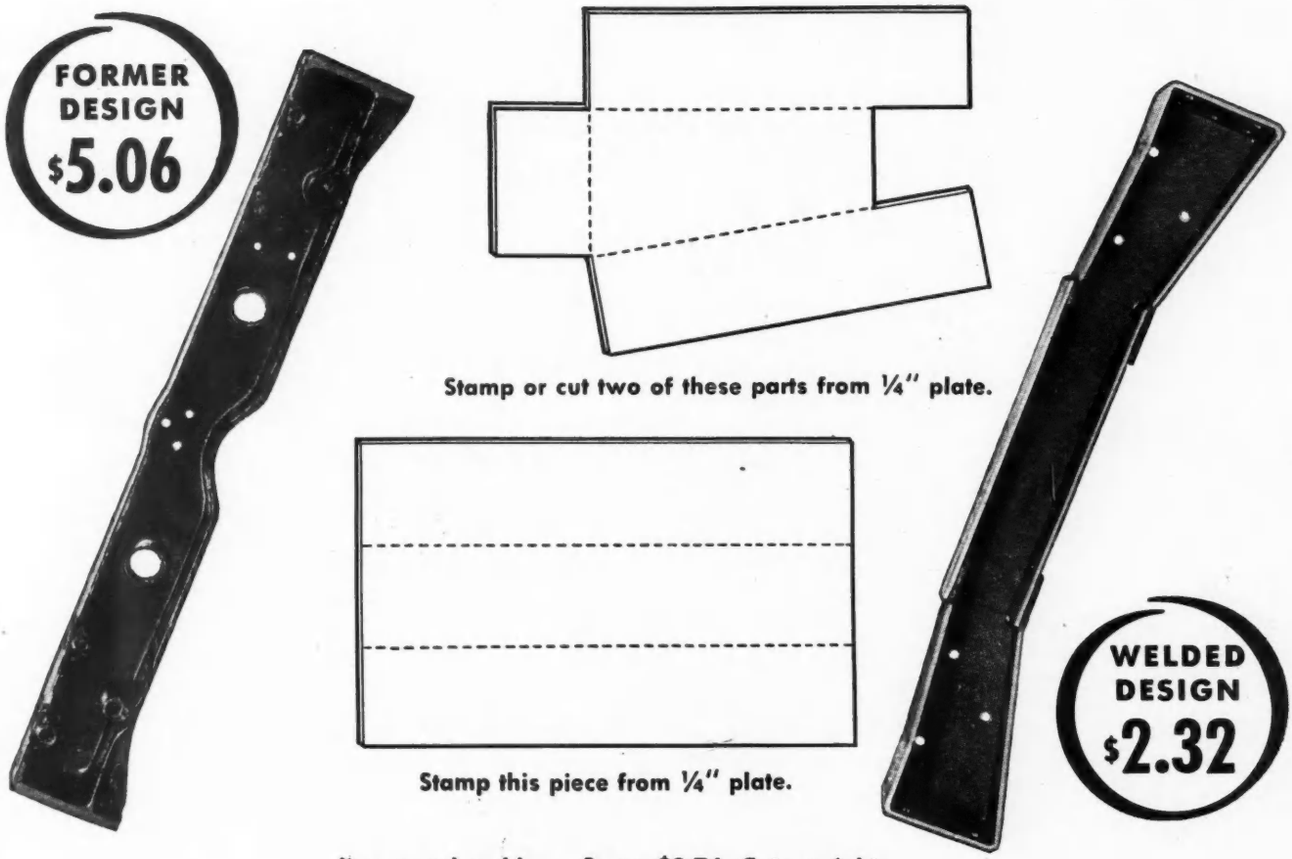
Call one of our local branch offices today, or write direct to the address below.

DETREX Corporation
DETROIT 3, MICHIGAN

S-125

LOOK, ERNIE, how new facts changed the status of this truck frame member:

NEW FACTS SAVE $2.74 PER PART



Jig up and weld . . . Saves $2.74. Cuts weight from 33 lbs. to 23 lbs.

Old Facts. Former design of conventional construction cost $5.06 each and weighed 33 lbs.

New Facts. Information on welded design led to a construction that costs only $2.32 and weighs 23 lbs. Is made as shown in sketches.

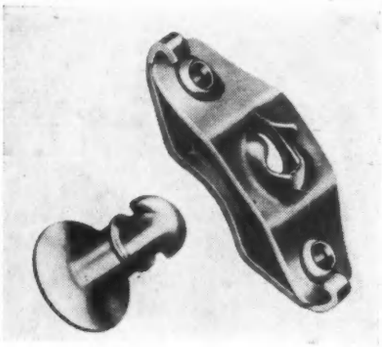
Changed Status. Welded design saves $2.74 per part and cuts weight 10 lbs. Produces a stronger and more rigid product . . . one that can be constantly improved, easily and quickly.

The Lincoln Engineer nearby will gladly acquaint you with the latest facts about arc welding. Studies in Machine Design free on request to engineers.

THE LINCOLN ELECTRIC COMPANY • DEPT. 393 • CLEVELAND 1, OHIO

America's greatest natural **recourse**

ARC WELDING



Lion fastener

round head, flush head, or wing head.

The spring assembly, comprised of cantilever type spring and base, is a pre-assembled unit, ready to install. The base forms a supporting member for the spring under extreme loads. The spring, of floating leaf construction, is held by retained lugs at each end of the base. It is formed with a double set of grooves and cams which interlock with the notched shoulders of the stud.

Kant-Mar Hammer

A new hammer with an unbreakable hard plastic head is now being delivered by the Schmidgall Manufacturing Co., 307 Cass Ave., Peoria 2, Ill. The "Kant-Mar" is said to be particularly useful on flat metal surfaces where mars, dents and blemishes on dies and fixtures must be avoided. In foundries it can be used tapping core boxes and general use.

The head is die cast non breakable,

Kant-Mar hammer

fire proof, acid proof, non conducting material. The base of the head is machined from special light weight aluminum alloys, securely fastened to the head but interchangeable. The handle is hickory.

COOLING SYSTEMS, TOO need CONTROL!
Controlled cooling, as achieved by modern cooling systems with Dole Thermostats, is a simple assurance of top performance. Savings in gas, oil and motor wear through reduced crank case dilution are important plus values
DOLE
Thermostats
in a range of types for every car
THE DOLE VALVE COMPANY
1901-1941 Carroll Avenue, Chicago 12, Illinois
Los Angeles
Detroit
Philadelphia

Automatic Metallic Arc Welding

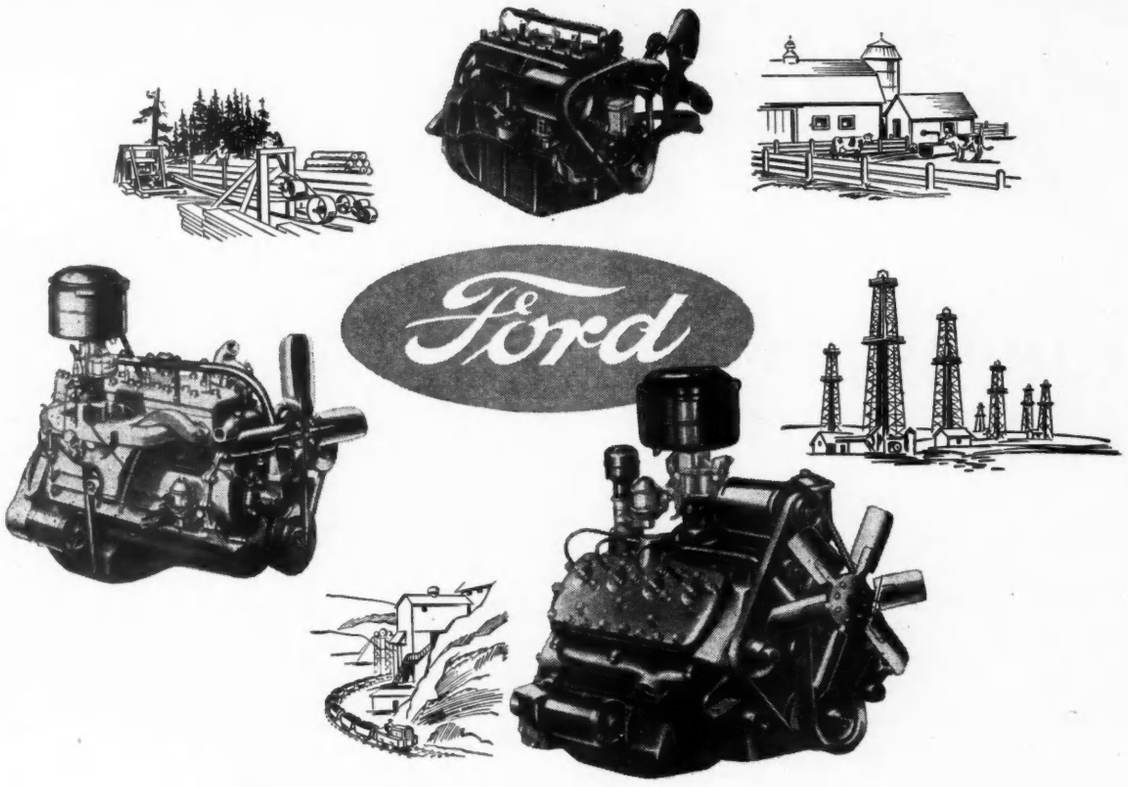
(*Continued from page* 27)

one end of the travel beam on which it is mounted; the carriage is lowered to welding position; and the entire unit then moves along the beam under its own motor power, from left to right.

As the carriage progresses, a granular flux is fed just ahead of the arc completely covering it and protecting the molten weld metal from the atmosphere. When the weld metal solidifies it forms a dense uniform bead of excellent quality. About 75 per cent of the flux is recovered and screened for re-use.

Welding speed is at the rate of 22 in. per min or approximately 10 completely welded frames per min with about five min required to unload and reload the fixture. Bare wire electrode of 7/32 in. diameter is used single pass, with weld penetration of 75 per cent. Current setting is at 750 amp, 32 v.

The finish welded frames are usually inspected with little or no rejects. This automatic metallic arc welding installation, as shown in Fig. 3, may be applied to the fabrication of items of similar design with slight modification.



Ford Engine Power

FOR ANY INDUSTRIAL EQUIPMENT

—offers recognized plus-values in Economy, Efficiency, Reliability and World-Wide Service Facilities

When a manufacturer of any gasoline-engine-driven equipment selects a Ford-built engine for power, everyone concerned benefits.

The units are more readily sold, because millions of people favor Ford engines. This benefits the manufacturer of the equipment, and those who sell it for him.

The reasons that make Ford-powered equipment more *salable* are the direct benefits which Ford power brings to the operator.

He knows, when he sees Ford power in the specifications of his new light plant, pump, compressor unit, saw-rig, mill or blower, that he can feel sure of economy, efficiency and reliability, backed by more than forty years of experience, in the service of millions of owners. He knows he can count on Ford Service whenever or wherever he needs it.

Three time-proved Ford-built engines are now available to manufacturers and individual purchasers—the 40-H.P. Four, the 90-H.P. Six and the 100-H.P. V-8. Each offers sure, enduring power applicable to a wide range of uses. For detailed specifications and dimensional data, write—

FORD MOTOR COMPANY
Industrial and Marine Division, Dept. 100
Dearborn, Michigan

AVAILABLE
NOW!

Specifications and designs subject to change without notice.

HARRIS

COMPRESSED-RUBBER JOINTS

USED IN SHOCK ABSORBERS

A typical application of Harris COMPRESSED-RUBBER Joints is at the ends of direct-acting shock absorbers as applied to automobiles, trucks and railway coaches.

Other applications of these COMPRESSED-RUBBER Joints are in spring shackles, radius rods and many other types of links and lever arms which embody oscillating joints.

Harris COMPRESSED-RUBBER Joints require no lubrication, operate noiselessly and practically without wear, cushion shocks and absorb vibration. They are applicable to all sorts of equipment and we have supplied industry with millions of these joints.

If you have a wear or noise problem in connection with any oscillating joints, we welcome the opportunity to furnish the answer.

HARRIS PRODUCTS CO.
CLEVELAND 4, OHIO, U. S. A.

Tax the Cooperatives

(*Continued from page* 15)

hundreds of others like it. The National Farm Machinery Cooperatives bought the Ohio Cultivator Co., a manufacturing corporation which formerly paid income taxes. The tax loss in that case amounted to about $200,000 a year. And so on and so forth. And besides that, cut-price selling of cooperatively bought or manufactured products reduces the income of and, hence, the taxes paid by other competitive businesses.

The labor unions—some of them anyway—are considering the undertaking of cooperative enterprises, and that is going from bad to worse. Things as they are are bad enough to call for vigorous remedial action. The cooperatives, like the labor unions, are ambitious and full of ideas both economic and political. "The ultimate destiny of the consumers' cooperative movement," said Dr. J. P. Warbasse, President emeritus of the Cooperative League of U. S., "is to obtain or to produce in factory, shop, mine, sea, air and land, all that the consumers require." C. R. Egley, manager of the Cooperative Farmers' Union Live Stock Commission goes even farther fanatically, "We must get rid of the profit system," he is quoted as having said, "and replace it with the cooperative system." He added the assertion that there can be no economy of abundance and no equitable distribution of income "if we continue with an economic system based on private ownership."

It would be wrong to attempt to give the impression that all managers and motivators of cooperatives are as radical as Mr. Egley's quoted statements would indicate that he is. Furthermore, for certain portions of our population, there are undoubted advantages to be derived from certain types of cooperative enterprises. But taxing them properly would not deprive them of anything that is economically sound from the viewpoint of the general welfare.

It is by no means an indulgence in wild guessing to say that if cooperatives, together with government owned businesses, mutuals and other similar enterprises that are now tax exempt, were compelled to pay income taxes, the Government could collect increased revenue to the extent of a billion dollars a year and the tax load on other business and on individuals could be materially lightened.

The literature on cooperatives is extensive. It should be more widely read. The facts about cooperatives and taxes and unfair cooperative competition with tax-paying business should be more profusely spread about. Our lawmakers should be reminded of those facts persistently, forcefully and comprehensively.

When you have the salesman's word that his steel foundry can more than meet your specifications for physical properties, finish, dimensional accuracy, and internal soundness, are you all set?

No. There is something else. Your $64 question is, "What precautions or procedures does your foundry take to insure that every casting will ring the bell?"

Racine Steel Castings Co. long before the war was at the forefront in setting up foundry procedures for insuring as far as possible that every customer would get his castings as specified and required.

1 Before your pattern is prepared for production, it is examined by our engineers to determine if it will produce the casting you want most economically for you.

2 A test casting is poured and X-rayed under high power to check internal soundness. If weaknesses appear, foundry practice is changed to try to overcome them. If this can't do it, design changes are worked out with you.

3 A complete layout check for dimensional accuracy in all planes is given the test casting. If tolerances are exceeded, the casting goes back for revision of pouring practice or even again of design.

4 Your pattern is put into production only after test castings rate perfect. All the way through production, close control is maintained by laboratory and foundry technicians.

5 Before the shipping department gets your castings, they have run the gauntlet of an independent Inspection Department that gives them a thorough going over for surface and internal defects, straightness, and adherence to dimensions. No cripples pass.

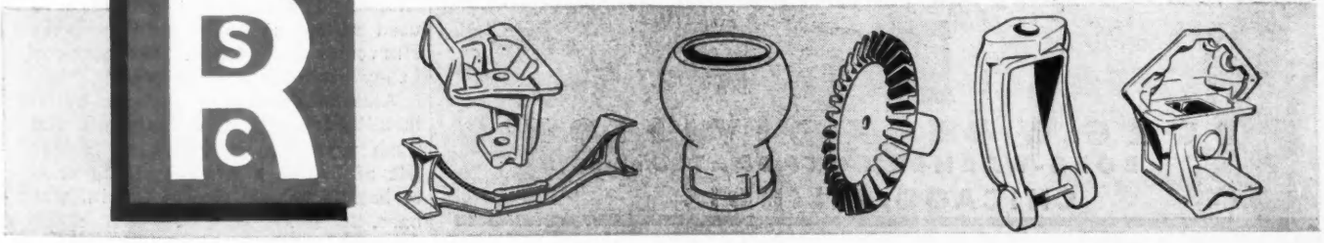
In short, it is one thing to set up specifications; it is another thing to know what your chances are of having every casting meet them. Buy your steel castings where that chance is closest to 100%.

RACINE STEEL CASTINGS CO.

DIVISION OF BELLE CITY MALLEABLE IRON CO.

RACINE, WISCONSIN

Racine Carbon and Alloy Steel Castings



Clark's New Laboratory

(*Continued from page* 21)

is pertinent to the testing of fluid drive devices such as torque converters, etc.

To overcome the inherent problem of low output shaft speeds when simulating low gear vehicle operations of heavy duty axles, Clark engineers designed and built two step-up gear boxes, one cradled ahead of each absorption dynamometer. These are of double planetary design arranged for mechanical shifting in three ranges—direct, 4.5 to 1, and 20 to 1. These gear boxes are lubricated under pressure and have jacket cooling to provide temperature control. Clark engineers also designed a cradled fixture which is installed on the bed of the motoring dynamometer. This fixture makes it possible to directly indicate the output torque of the transmission, which is the same as the input torque to the axle.

The building is provided with a heavy duty crane which can be used for moving any of the test equipment; also for moving the elements of the dynamometer into any desired position.

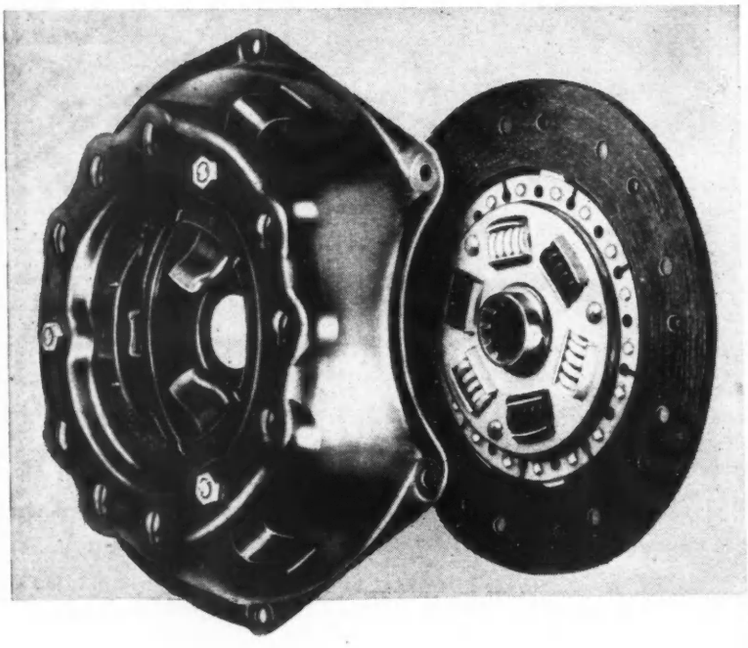
The particular machine used for fatigue, torsion and bending tests of axles, housings or axle shafts, considered with the fixture with which it is equipped, exemplifies modern practice. The machine (see illustration) is hydraulically-operated, of vertical type to conserve space and facilitate handling of samples, making a compact, self-contained unit of sufficient capacity to handle the largest shafts or housings at present contemplated. The hydraulic ram will deliver 4000 lb at any stroke between 2½ and 12 in. Instruments are provided for reading peak hydraulic pressure, maximum deflection of object tested, and total cycles.

Since the maximum deflection specified for the fatigue test is based upon actual operating conditions, the fatigue testing machine is used in conjunction with the Tinius-Olsen standard universal testing machine with electronically-operated load-holding device installed on it. This is a hydraulically-operated machine having a maximum capacity of 160,000 lb. While it can be used at will for the gamut of tension and compression tests, its principal function here is to establish accurately the maximum deflection of test axle housings, drive shafts, etc., under specified conditions of loading. Once the deflection has been established, the specimen is transferred to the fatigue testing machine where the ram is adjusted to give the same deflection.

Another unit is a Tinius-Olsen torsion machine of 600,000 lb in. capacity, capable of breaking steel shafts up to 4¼ in. in diameter. This unit is of the direct recording type. It will be used largely for the investigation of axle shaft design. The last machine in this row is the familiar Gleason type for measuring deflections in gear trains and complete gear box assemblies. It has been a part of Clark laboratory equipment for many years and has been found invaluable in testing transmissions and axles to develop fundamental data as to gear train and housing deflections, as well as for investigations of noise and service life. The four-square machine, located adjacent to the dynamometer, is designed for the testing of both axles and transmissions.

At the extreme end of the laboratory building is found a separate self-contained department for the servicing and testing of large vehicles such as trucks and buses, principally to develop data on the life and performance of axles and transmissions. Most impressive piece of equipment is the chassis dynamometer. In general design, it follows the pattern of the chassis dynamometer developed and used in recent years by International Harvester Co. It is of the water-cooled prony brake absorption type.

Also in this section of the building is a 30-ft wash and drain pit and a flush type Weaver two-post hydraulic lift of 26,000 lb capacity long enough to handle vehicles up to 300-in. wheelbase.



Engineered by Borg & Beck

means . . . built by the makers of the clutch that is faithfully serving in nearly half the automobiles, trucks, and tractors in operation today!

You can depend on—

BORG & BECK

For that vital spot where Power takes hold of the load!

BW

BORG & BECK DIVISION
BORG-WARNER CORPORATION
CHICAGO, ILLINOIS

STAINLESS STEEL MILLING

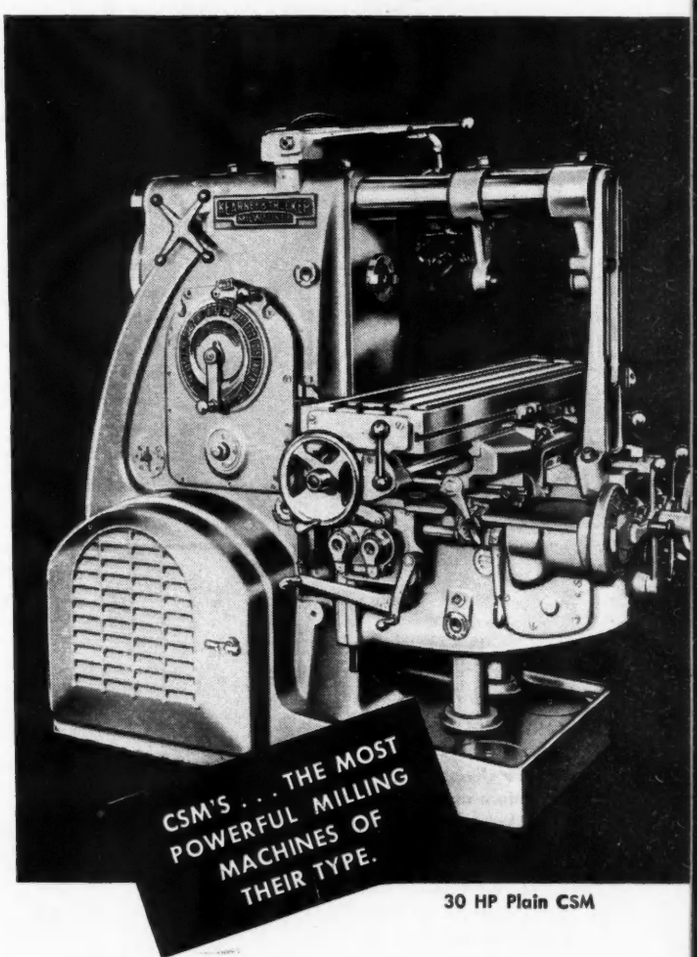
made easy on a
KEARNEY & TRECKER CSM

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been stabilized after complete analysis of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards and will cut metals faster and to finer tolerances and superior finishes than ever before — with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.

Write for complete data on CSM machines — CATALOG CSM-20. Please indicate your business connection.



30 HP Plain CSM

KEARNEY & TRECKER CORPORATION
MILWAUKEE 14, WISCONSIN

"Be ready for tomorrow with **CSM's"**

GM to Build Two Plants For New Light Chevrolet

Two new General Motors plants, to be constructed in Cleveland for the manufacture of a new light Chevrolet car, will employ about 10,000 workers, according to an official announcement.

Application already has been made to the Civil Production Administration for authority to erect the new plants at once. The two plants will have a total floor space of approximately 2,500,000 sq ft. One of the plants will be used for the manufacture of motors, axles, transmissions and other component parts for the new car, and the other will house the pressed metal, body and assembly departments. There also will be administration, service parts, and engineering buildings.

Advertising Note

J. Edward Schipper, who recently resigned as president of Schipper Associates, has been appointed manager of the Detroit office of Kudner Agency, Inc., according to an announcement by J. H. S. Ellis, president of Kudner. Mr. Schipper will join the Kudner organization July 1.

Mr. Schipper, an engineering graduate, first became associated with the automotive industry as technical editor of the Class Journal publications which later merged with the Chilton Co.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE *and* AVIATION INDUSTRIES

A substantial decline of general business activity has been indicated. The *New York Times* index for the week ended May 25 stands at 110.9, as compared with 117.7 for the preceding week and 143.4 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended May 25 equaled 245 per cent of the 1935-39 average, as compared with 246 in the preceding week. Sales were 34 per cent above the corresponding distribution in 1945, as against a like advance of 38 per cent recorded for the week before. The aggregate in 1946 so far reported is 26 per cent greater than the comparable sum in 1945.

Electric power production during the week ended May 25 was slightly increased. The output was 9 per cent below the comparable amount last year, as compared with a similar recession of 10 per cent reported for the preceding week.

Railway freight loadings during the same week totaled 571,574 cars, 17 per cent less than the figure for the week before and 35.3 per cent below the corresponding number a year ago.

Crude oil production in the week ended May 25 averaged 4,759,100 barrels daily, 7750 barrels more than the average for the preceding week but 107,665 barrels below the comparable figure in 1945.

Bituminous coal and lignite production during the week ended May 18—reflecting a "truce" in the coal strike—was estimated at 9,300,000 tons, as compared with 470,000 tons in the week before and 11,234,000 tons a year ago. The output in 1946 so far reported is 23.6 per cent below the corresponding production in 1945.

Civil engineering construction volume reported for the holiday-shortened week ended May 30 by *Engineering News-Record* is $71,855,000—31 per cent less than the figure for the preceding week but 236 per cent above that reported a year ago. The total recorded for twenty-two weeks of 1946 is 203 per cent more than the comparable sum in 1945. The increase shown for private construction is 596 per cent, and the advance in public construction is 51 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended May 25 is 110.7 per cent of the 1926 average, as compared with 110.9 for the preceding week and 105.9 a year ago.

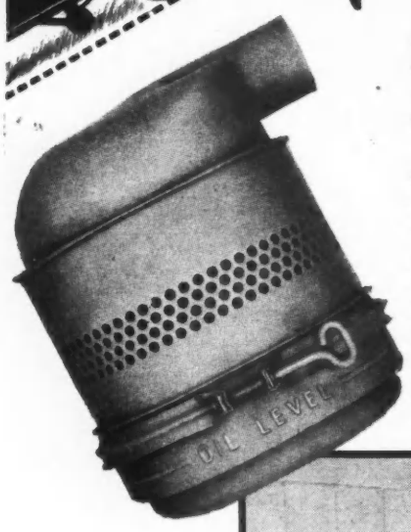
Member bank reserves increased $184,000,000 during the week ended May 29. Underlying changes thus reflected include a rise of $424,000,000 in Reserve bank credit and a gain of $119,000,000 in Treasury deposits with Federal Reserve banks, accompanied by an increase of $145,000,000 in money in circulation.

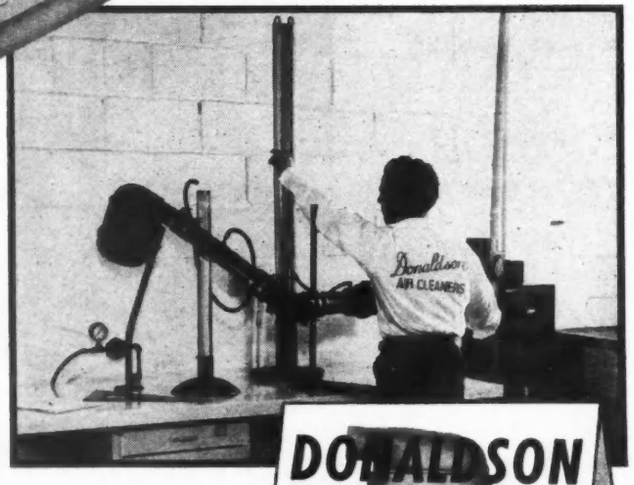
Total loans and investments of reporting member banks increased $89,000,000 during the week ended May 22. A rise of $6,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $7,467,000,000, shows a net increase of $1,677,000,000 in twelve months.

A new slant on ANGLE OPERATION

Over the road trucks and busses have their ups and downs too . . . on hills that is. During every climb and descent, certain changes occur inside the air cleaner, particularly a shift in the oil level.

To make certain of dust removal efficiency regardless of operating angle, Donaldson engineers run extensive tests like the one shown below, with the cleaner mounted at every angle which might be encountered in actual operation. These tests show that even when tilted as much as 30° Donaldson Cleaners maintain a dirt removal efficiency close to 100%. When you equip your engines with Donaldson Oil-Washed Air Cleaners, you are assured of *proved protection* against abrasive dust.





ANGLE TEST FOR OIL PULL-OVER
With air cleaner tilted to maximum angle which might be encountered in the field, pump simulates actual engine air demand. Technician checks observation window in outlet for evidence of oil pull-over.

DONALDSON Oil-Washed AIR CLEANERS

DONALDSON CO. INC.
666 PELHAM BLVD.
ST. PAUL 4, MINN.

SALES ENGINEERS: Chicago Cleveland Detroit

to select the BEARINGS

For the Engineer

A handy file folder containing a wealth of valuable data on Sleeve Type Bearings. Write for your FREE copy.

● The world is waiting anxiously for the new products of American genius. Much has been written about the new materials . . . new methods of manufacturing . . . new finishes that are now available. Never before has the designer had such a golden opportunity to break with the past and to strike out for the future. If the new product contains a motive unit, great care should be exercised in selecting the CORRECT bearings. The RIGHT time to decide what bearing will deliver the greatest performance . . . for the longest time . . . at the lowest cost is *before* production has started. The easiest way to determine this is to call in a Johnson Bronze Engineer. Permit him to review the application . . . to make a recommendation based on facts . . . free from prejudice. Remember, only Johnson Bronze makes EVERY TYPE of Sleeve Bearing. We are ready to serve you NOW!

JOHNSON BRONZE CO.
625 S. MILL STREET NEW CASTLE, PA.

ATLANTA . . . BUFFALO
CAMBRIDGE, MASS.
CHICAGO
CINCINNATI
CLEVELAND
DALLAS
DETROIT
KANSAS CITY

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS

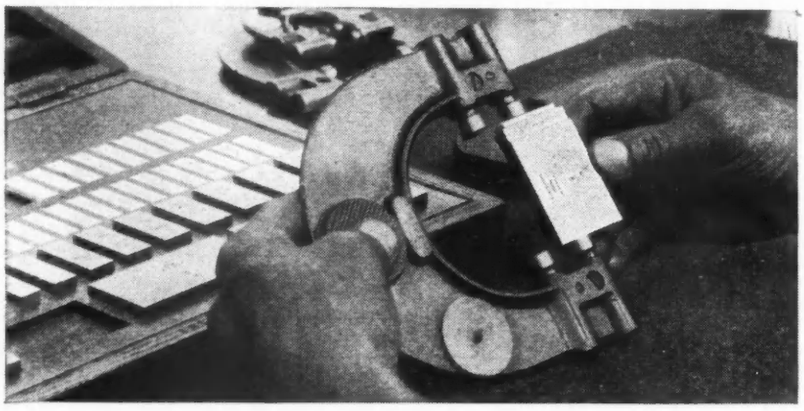
LOS ANGELES
MINNEAPOLIS
NEWARK
NEW YORK
PHILADELPHIA
PITTSBURGH
SAN FRANCISCO
ST. LOUIS . . . . SEATTLE

Dow Research Laboratory

A new laboratory has been set up by The Dow Chemical Co. The building to house its operations has just been occupied. This group will continue and greatly expand the metals and cathodic protection research program begun six years ago. Emphasis will be given to further study and development of magnesium for cathodic protection. The success thus far of magnesium used as an expendable galvanic anode in preventing corrosion of underground pipe lines has warranted an extensive study of the whole problem.

Bombers to Become Boats

Two PBY's, minus wings, are to be part of an experiment by a Seattle boat builder to see if the hulls can be converted into satisfactory pleasure cruisers. Many alterations will be necessary to the one shown here to adapt it to its new job. Acme photo.



TOLERANCES WORTH MAINTAINING ARE WORTH JO-BLOCK PROTECTION

When you set up dimensional inspection tolerances, it's to insure a specified class of fit in assembly, or to make sure of parts-interchangeability, or for some other good reason. The harder it is for an inspector to be *sure* he's staying within limits, *the more it costs.*

So, why not put a set of Ford Jo-Blocks on guard? Make it part of somebody's routine to check every working gage—whether snap-gage, micrometer caliper, dial indicator, plug-gage, ring-gage, or any other dimensional test device—with genuine Ford Jo-Blocks at definite, frequent intervals. Then, you'll *know* that everybody concerned is "speaking the same language" of measurement. Chances are that inspection will speed up and rejections will be fewer.

Jo-Blocks are not expensive. They're made to three warranted accuracy standards—plus or minus .000002", .000004" and .000008". Sold throughout the Americas as single blocks or in varied sets (metric measurement, too). A full line of extremely useful accessories available to expand and facilitate use of Jo-Blocks.

FREE—NEW CATALOG

Write for catalog No. 17, containing illustrated applications of dozens of Jo-Block uses. Address: Ford Motor Company, Johansson Division, Dearborn, Michigan, Department 63.

Ford Johansson GAGE BLOCKS

Aluminum Co. of America To Build Large Plant

The Aluminum Co. of America, has announced plans for the construction of a large new plant near Davenport, Iowa, for the rolling of aluminum sheet and plate. The plant, which is to cost more than $30 million will have the capacity to produce more than ten million lb of sheet and plate per month when placed in operation. Construction is scheduled to begin as soon as the project has been approved by the Civilian Production Administration, and completion of the plant will require approximately 18 months.

An outstanding feature of the new plant will be its highspeed continuous "hot mills" and "cold mills" capable of rolling sheet up to 120 in. in width. This equipment will produce aluminum sheet and plate in all forms. Also of interest is the fact that the Davenport plant will be able to roll aluminum plate in sizes fully covering shipbuilding needs.

Record Stakes for 1946 National Air Races

An all-time high in prize money is offered to racing pilots who participate in the 1946 National Air Races to be held at Cleveland, Aug. 30, 31, Sept. 1 and 2.

A prize total of $109,500 already has been announced against $85,000 total for the last race meet held in 1939. Air race officials predict that this big figure will be materially increased before the races get under way.

Advertising Note

The Irving Air Chute Co. of Buffalo, N. Y., manufacturers of aviation safety devices, announces the appointment of the Addison Vars Co., also of Buffalo, as advertising agents.

Christian Girl

Christian Girl, 71, retired automobile spring manufacturer, died June 10 at Lakeside Hospital in Cleveland after a long illness.

50 years

OF PUTTING AUTOMOBILES ON THEIR "FEET"— AND KEEPING THEM QUIET

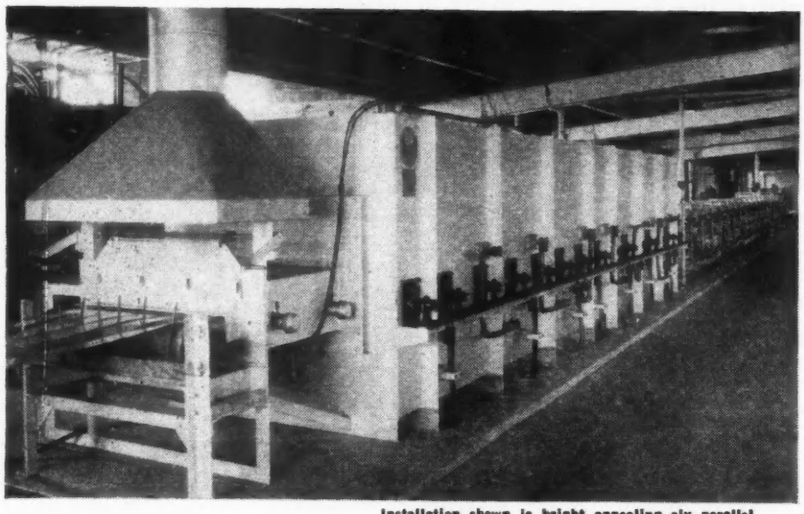
Through the years when we made wood, wire and steel automobile wheels - - - then through the war years with airplane wheels and brakes on every U. S. 4-engine bomber, plus thousands of other aircraft - - - and now into peacetime with automobile fans, mufflers, moldings and other parts - - - the Hayes name and today's Hayes Industries products are synonymous with quality in design, production and performance.

Hayes manufacture and Hollerith engineering - - - in automotive parts, and magnesium and aluminum die-castings - - - seek to provide components that put reliability, efficiency and sales value into automobiles and other products.

HAYES INDUSTRIES, INC.

JACKSON, MICHIGAN

FANS · MUFFLERS · MOLDINGS · OTHER PARTS



Installation shown is bright annealing six parallel strands of cold rolled steel strip. Handles any width up to 30". Wider sizes available.

EF Furnaces for

Bright Annealing and Normalizing Strip — Continuously

For Hot or Cold Rolled; High or Low Carbon; or Stainless

Sizes to handle 1000 to 28,000 lbs. per Hour

Quicker deliveries, shorter annealing time and less material in process . . .

Continuous operation, uniformity of finish and anneal . . .

Elimination of pickling, moderate floor space requirements and low operating costs.

These are some of the advantages of EF continuous controlled atmosphere furnaces for bright annealing and normalizing strip.

The finish and anneal are uniform as the material is annealed in strip form, and every linear foot is therefore subjected to the same temperature and conditions regardless of the tonnage.

The anneal is secured in a few minutes in place of hours . . . requiring less material in process.

Can be built in sizes or batteries to handle any width or tonnage required.

ELECTRIC AND FUEL FIRED EF FURNACES

We are in position to design and build the size and type best adapted to your particular plant, product, and production requirements.

We solicit your inquiries covering production furnaces for handling strip or other products in any size or shape — no job is too large or too unusual.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

For Production Furnaces

For Handling Products in Any Size or Shape

FURNACES OIL, GAS or ELECTRIC

For Every Heating and Heat Treating Process

Aluminum Brazing
Annealing
Billet Heating
Bright Annealing
Bright Hardening
Copper Brazing
Controlled Atmosphere
Carburizing
Drawing
Enameling
Forging
Hardening
Malleablizing
Silver Soldering
Nitriding
Normalizing
Soaking Pits
Scale-Free Hardening
Quenching Machines
Ceramic Kilns, etc.
Process Heating

ELECTRIC FURNACES FUEL FIRED

We Build the Furnace to Fit Your Job

THE ELECTRIC FURNACE CO.

SALEM, OHIO

For Production Furnaces, For Any Process or Production, Consult

The Electric Furnace Co., Salem, Ohio

No Job Is Too Large or Too Unusual

Essentials of Good Purchasing

(*Continued from page* 33)

quently, some purchasing agents may be content to sit tight at their desks, handle visiting salesmen as intruders and take an independent attitude.

The alert purchaser has an accredited list of suppliers for all of his commodities. This is carefully assembled after much investigation and experience, it represents those who are able to supply what he wants, in quantities he demands, and at reasonable prices. The list is constantly being added to and revised as he learns of new commodities and new producers.

The purchasing agent is a man who must insure his company against all possible emergencies in relation to material supplies. He must have ready sources to which he can turn should his company introduce new products, increase their demand for materials suddenly, cancel deliveries on outstanding orders or face a rush order.

Salesmen are the public representatives of the businesses for which they travel. They should be received as busy business men who have come to bring you the newest developments in their line.

All visiting agents should be seen by some one from the purchasing offices. Some will be permitted to tell their story outside the office and dismissed with a word. Others will be invited in for a few minutes, while they relate the purpose of their call, others, will be interviewed by an assistant to special buyers. But all should be seen by someone and without much delay. This practice will permit great saving in selling expenses and thereby, in costs. About 40 per cent of the salesmen's time is spent in waiting for interviews. Direct selling costs represent eight to 10 per cent of the sales prices, so if salesmen's time can be conserved, considerable saving is possible.

Establishing Prices

I believe that most purchasing agents agree that little real gain is to come from beating down prices and driving hard bargains, such a purchasing agent gets a reputation and sooner or later will get caught and will then be forced to pay the price. Driving sharp bargains is a primitve way of doing business that causes ill-will, ruthless competition, unfair market practices, and much economic loss. But where is the dividing line between a fair price and a sharp price?

Certainly the buyer cannot afford to pay an excessive price and his first duty is to protect his firm against this. He shops around, receives competitive bids and makes mental or extended cost analysis to determine what is the production cost and a reasonable profit to the vendor. It is his duty to obtain this

(*Turn to page* 94, *please*)

Underpass Curve-Shaving Boosts Gear Output *Over 200%* per machine

A large gear producer was getting 36 eight-pitch 24-tooth cast iron timing gears per hour on his gear finishing machines, removing .004 to .006 inches of stock, measured across pins.

When he installed a MICHIGAN underpass gear finisher in the line, however, output on the one underpass machine was more than total output on three of the other type—110 gears per hour.

Of interest is the fact that the underpass shaving cutter *curve-shaved* the gears at the same time that it finished them to within .0002 in. of spacing error and within .001 inch for eccentricity.

Curve-shaving—which crowns the faces of gear teeth—is built right into the underpass cutter, eliminating cam mechanisms, rocking motions, etc.

For complete information on MICHIGAN underpass gear finishing machines, ask for Bulletin #860A-44

ORIGINATORS of GEAR-SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

price, if possible, and if he knows what a fair price is, the buyer is most likely to get it. But a purchaser must not labor under the impression that he should always assure the vendor his costs and a reasonable profit, because a particular vendor is apt to be an inefficient or high-cost producer. To assure such producers profits is to block the operation of the competitive system. Sufficient pressure must always be exerted on producers to keep them striving to lower costs and improve the values of their product.

The purchasing agent must protect honest business and assure legitimate profits, yet prevent toll and above all, keep up the continual competitive struggle between producers.

Reciprocity

Reciprocity is a subject that frequently must be considered in considering buying and selling relationships today. Seemingly it is quite prevalent. The sales force may bring pressure on the purchasing agent or the vendor may mention the orders given the buyer's company and insinuate or threaten the removal of this business unless the buyer accepts their proposition. Some companies supply their salesmen with lists of their suppliers and request them to use the reciprocity argument. How much is the argument worth? If a concern feels like paying premiums to make sales which are not at a premium, no one can prevent it. It is an uneconomical policy, if it costs the buying department money above the fair market price. Any concern will, out of the spirit of fairness, buy goods of its customers but if it sells the goods in competition with others, it should demand that the customer meet competition as well. The purchasing agent can get this point of view across, generally, if he sticks to his principles of fair dealing.

The trouble-free performance of the Atwood Spring Loaded Clutch is an outstanding engineering achievement accomplished through simplicity of design incorporating a minimum number of parts.

OVER A MILLION ATWOOD CLUTCHES IN SERVICE

*THE ATWOOD CLUTCH COMPANY

AUBURN, INDIANA, U. S. A.

*Formerly Auburn Manufacturing Company

The SAE Holds Forth

(*Continued from page* 19)

Owens-Ford. The author gave the objective results without the usual conclusions or recommendations. It is evident that in the present state of the art, the plastic materials exhibit dramatic resistance to impact but fall far short of requirements for abrasion resistance. However, as we mentioned some time ago at least one major motor car producer has been doing extensive work in this field and expects to have plastic transparencies suitable for side windows, although windshield materials still are not in the immediate future picture.

The program provided for 19 technical sessions with more than 50 speakers scheduled for the presentation of papers and for the leading of discussions thereon. Also on the agenda for entertainment and delectation were a banquet on Sunday night, golf, tennis and field events and a display and parade of antique cars commemorating the Golden Jubilee of the automotive industry. Besides all this there was an extensive exhibition of enemy aircraft and automotive engines and equipment.

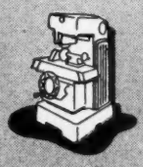
Standard Oil Co. Holds Technical Meeting

The successful character of a three-day technical meeting held recently in Hot Springs, Va. for discussion of current refinery, research and process control problems and developments has led The Standard Oil Co. (Ohio) to schedule annual meetings of this type for key members of its technical staff.

Sixty of the company's research and refinery engineers, chemists, refinery managers and manufacturing executives participated in the first of these sessions which was planned by E. B. McConnell, general manager of the manufacturing department. The program included presentation of a number of original papers by members of the Sohio staff on process, testing and research questions concerning operating methods and product development work.

Your Most Direct Source of Information ON

GEAR SHAVING



Red Ring Gear Shaving Machines correct gear cutting errors and improve gear tooth surfaces on spur and helical gears up to 220" PD.—Also to develop Elliptoid tooth form on gears up to 36" P.D.

GEAR LAPPING

Red Ring Gear Lapping Machines process spur, helical, shoulder and cluster gears removing heat treat distortion and giving fine finish.

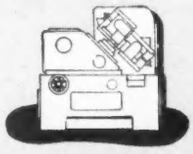
GEAR SOUND TESTING

By testing a pair of gears on a Red Ring Sound Tester you determine before assembly the type of bearing and the noise factor when encountered.

GEAR CHECKING

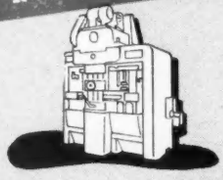
The Red Ring Universal Gear Checker shows quickly and accurately errors in index, helix angle, tooth size, eccentricity, interference and wobble.

ROTO SHAVING



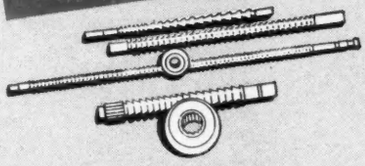
The Red Ring Roto Shaver finishes cylindrical, conical and flange surfaces faster and more effectively than can be done by green grinding.

ROTO MILLING



The Red Ring Rotomill Machines cylindrical work, conical work and flanged parts faster and more economically than can be done on a lathe.

BROACHES



Red Ring Naloy Broaches because of the methods of fabrication and treatment give you 50% more production per grind than conventional tools.

NATIONAL BROACH REPRESENTATIVES

BUFFALO 7, NEW YORK
George Keller Machinery Co.
1807 Elmwood Avenue

CHICAGO 6, ILLINOIS
C. L. Glover and C. E. Hartley
565 W. Washington Blvd.
Room 308

CLEVELAND 13, OHIO
Wyatt Sales Co.
Rockefeller Bldg.

DAYTON 9, OHIO
Walter R. Olt
306 Abington Road

DENVER, COLORADO
Hendrie & Bolthoff Mfg. & Supply Co.
1635 Seventeenth St.

FLINT, MICHIGAN
Hall Sales & Engineering Co.
920 Walnut Street

FORT WAYNE 6, INDIANA
I. R. Thornburg
3717 Hoagland Avenue

GRAND RAPIDS, MICHIGAN
Joseph Monahan
351 Indiana Avenue, N. W.

HOUSTON, TEXAS
Hugo-Fayle Company
1011-13 Caroline Avenue

LOS ANGELES 11, CALIF.
Machinists' Tool & Supply Co. (Broaches)
3690 Santa Fe Avenue
Moore Machinery Co. (Machine Tools)
3876 Santa Fe Avenue

NEWARK 2, NEW JERSEY
F. P. Harrigan
1060 Broad Street

PHILADELPHIA 3, PENN.
Conner Machinery Company
1701 Arch Street

RACINE, WISCONSIN
Hollis V. Gordon
1602 College Avenue

ST. LOUIS 17, MISSOURI
W. H. Sheer
7430 Bruno Avenue

SAN FRANCISCO, CALIFORNIA
Moore Machinery Company
1699 Van Ness Avenue

SEATTLE, WASHINGTON
Hallidie Machinery Company
2245 First Avenue, South

SYRACUSE, NEW YORK
C-H Briggs Machine Tool Co., Inc.
Onondaga Hotel Building

TOLEDO 2, OHIO
G. E. Sanderson
1220 Madison Avenue

WASHINGTON 6, D. C.
Glassie Co., Don Caffery
Jefferson Bldg., 1227 19th St., N.W.

WILBRAHAM, MASS.
Richard S. Brown
P. O. Box 158

WILKINSBURG, PENN.
Walter J. Greenleaf
Penn Building

CANADA

MONTREAL, QUEBEC
F. F. Barber Machinery Co., Ltd.
410 St. Nicholas Street

TORONTO, ONTARIO
F. F. Barber Machinery Co., Ltd.
York and Harbour Streets

WALKERVILLE, ONTARIO
F. F. Barber Machinery Co., Ltd.
Imperial Building

NATIONAL BROACH AND MACHINE CO.

5600 St. Jean
Detroit 13, Michigan

RED RING PRODUCTS

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

Underpass Shaving of Gears and Pinions

(*Continued from page* 26)

a result, underpass shaving is used on all gears where face width is not excessive.

The increased speed of finishing with the underpass process is attributed to the fact that there is no lost motion in the process. Its use of tangential feed —with metal removal due only to the crossed-axis relation of cutter and gear —is said to be responsible for much of the high precision and the longer cutter life obtained.

As to "crowning" of teeth, Wisconsin Axle's practice is to 'curve-shave' the pinions only, since the gears are sufficiently accurate to make crowning of both pinion and gear unnecessary. On the underpass-shaved gears, the desired crown is built directly into the cutter, so that the shaving operation automatically produces the correct crown, without destroying the involute form. On transverse shaved pinions, the curve-shaving action is obtained by a cam arrangement which allows the cutter to shave somewhat deeper as it approaches the ends of the gear teeth, thus also retaining true involute form.

This arrangement provides all the advantages of compensating for minor variations in assembly with a total crown of only 0.00025 in per inch of tooth face width on both sides of the tooth.

Thirty-two different gears and pinions are shaved on six Michigan 862 machines, two operators being required to handle the six machines, which are automatic in operation and require only loading and unloading on the part of the operator. Set-up men assist the operators in changing over.

As they come from the finishing machines, gears and pinions must be within final gear tolerances. Any variation from these tolerances due to heat-treat distortion is corrected by lapping.

Following are the tolerances to which the 80 per cent of the gears and pinions are required to be held:

Tooth to tooth spacing....	within	0.0003 in.
Total accumulated spacing error	within	0.001 in.
Involute form, total error	within	0.0005 in.
Total allowable lead error per inch	within	0.0003 in.
Eccentricity at pitch diameter	within	0.003 in.

The remaining 20 per cent of the gears produced are used in installations where close tolerances are not considered essential.

From the finishers, gears go to a Blakeslee Niagara washer for cleaning with hot water containing Kelite before going to heat-treat. Pinions are carburized in pots and direct quenched in oil. Gears are hardened in a Surface Combustion pit-type gas carburizer and oil quenched in Gleason or Hannifin quenching presses.

Any scale or foreign matter is removed by a Wheelabrator Shot Blast, gears are washed again and then go to final inspection. The latter includes file-hard check to Rockwell C-57 to C-60 on the teeth. Shafts on the gears are required to have a finished Brinell hardness of from 295 to 320.

Wisconsin Axle Division maintains a completely equipped gear checking laboratory which plays an important function in production control. It is housed in a glass enclosed dust-proof room. One out of every 20 to 30 gears is completely checked as it comes from each of the rough-cutting, semi-finishing shaving and lapping operations.

In addition, roll fixtures, go and no-go gages and eccentricity checking devices are provided at inspection benches adjacent to the production operation for continuous check of gears in process. A metallurgical laboratory controls materials and heat-treating processes. Every heat of steel is also Checked at Timken-Detroit Axle Co. in Detroit before the gear blanks are forged for shipment to Wisconsin Axle Division.

BRAKE DRUMS

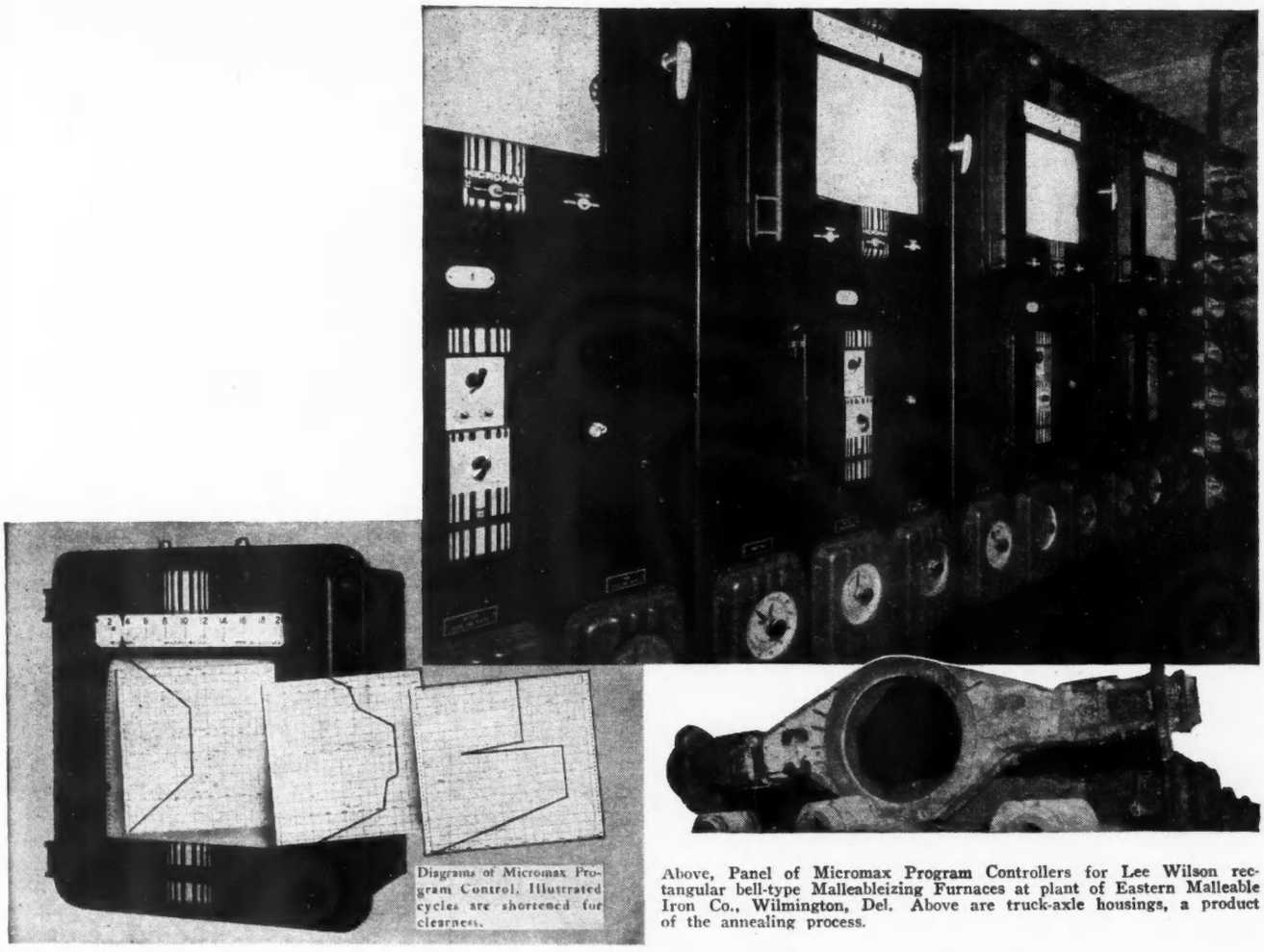
BRAKE SHOES

DEPENDABLE CASTINGS ENGINEERED TO YOUR NEEDS

In addition to making castings in ALL ferrous metals —gray iron, Gunite, malleable, and steel—we have an engineering and metallurgical staff thoroughly familiar with performance requirements. Our customers are invited to take advantage of our broad experience, based on 90 years in the foundry business, to help in selecting the correct material specifications for attaining better-than-expected results. We show here items of particular interest to automotive manufacturers — Cylinder Liners, Brake Shoes, and Brake Drums. Drums are completely finished in our own machine shop. *Let us quote on your requirements.*

MADE BY
GUNITE FOUNDRIES
ROCKFORD, ILLINOIS

GUNITE CASTINGS...FOR TRUCKS, TRACTORS, TRAILERS, *and* BUSES



Diagrams of Micromax Program Control. Illustrated cycles are shortened for clearness.

Above, Panel of Micromax Program Controllers for Lee Wilson rectangular bell-type Malleableizing Furnaces at plant of Eastern Malleable Iron Co., Wilmington, Del. Above are truck-axle housings, a product of the annealing process.

PROGRAM CONTROL

Increases the Efficiency of Malleableizing Operations

Automatic control of heating, soaking and cooling rates is making an outstanding contribution to the smooth, economical operation of malleableizing furnaces in the plant of Eastern Malleable Iron Co. Furnaces are Lee Wilson bell-type units, fired with producer gas and equipped with automatic temperature control by means of Micromax Program Control Pyrometers.

The Micromax Electric Control system is used, in which the instruments throttle fuel by means of heavy-duty, electrically-powered valve-drives mounted on the covers. The cable switchboard system at the Control Panel permits any Controller to be used with any valve-drive; an arrangement which gives great flexibility of operation. Heating, soaking and cooling cycles, after being manually pre-set, are automatically maintained with fidelity, to preserve the quality standards needed in good malleableizing.

There is a type of Micromax Program Control to meet the needs of practically any long-cycle heating operation, and an L&N engineer will be glad to help select the one you need, or will send a Catalog, as you prefer.

LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl Ad N-33A-666(1)

New Production Equipment

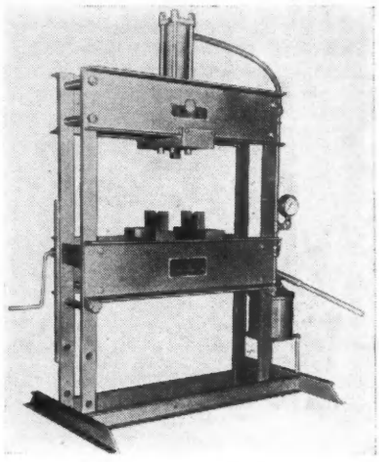
(*Continued from page* 45)

with either the Hardinge standard taper nose or Hardinge standard threaded nose. The headstock spindle is driven by a "center-drive" belt. The center-drive construction places the belt between the spindle bearings for balanced bearing spread and equal distribution of belt pull. The center-drive belt is easily replaceable without removing any part of the machine.

The turret head is mounted on preloaded ball bearings eliminating play between the turret head and turret slide. To eliminate radial play between the turret head and turret slide, the turret head index pin is mounted on preloaded roller bearings. The head is bored to take standard ⅝-in. shank tools. The turret slide moves on hardened and ground steel ways.

THE Rodgers "Sixty," a new shop press of sixty tons capacity, is offered to the trade by Rodgers Hydraulic, Inc., of Minneapolis, Minn.

Powers is supplied by a Rodgers two-speed hydraulic hand pump which, in high speed, moves the ram 2½ in. per pump stroke, giving up to 2,000 lb pressure in fast travel. Lever on the pump may be quickly flipped for high pressure operation.



Rodgers "Sixty" shop press

The hydraulic cylinder rests on rollers which ride the flanges of the upper bolster, and may be moved across the entire working width of the press when desired. Ram travel is 13 in. at a continuous stroke.

Flexibility of the press is achieved through adjusting the lower bolster by means of a hand crank. Maximum opening between bolsters is 38 in., minimum is 8 in. A special model with an opening range from 8 in. to 48 in. is available.

A TOOL BIT, incorporating new principles for the holding of the carbide tip, is being offered by the Super Tool Co., 21640 Hoover Rd., Detroit 13, Mich.

This tool is made up of a holder, supplied in a variety of standard sizes, and an insert bit of solid carbide which is held in place mechanically and can be replaced with a new one quickly.

Tool bit made by Super Tool Co.

It is designed so as to eliminate all outside holding mechanisms.

The insert carbide bits are large, providing a heavy cross section of carbide. The bits can be ejected easily for regrinding, the angle at which they are set enabling the user to sharpen the tool with a minimum of loss of carbide. This is due to the fact that the bit rises in the holder when ejected, allowing light grinding cuts on the top and side as well as on the end. There is no grinding of the steel shank required. The holders are universal, it being rarely necessary to vary the grades of carbides and the grind on the insert bits.

GOOD PRODUCTS DESERVE GOOD SPRINGS
Why tie up your engineers on special spring problems?
. . . when ours are at your service
Another Accurate service you'll like
Our engineers are long experienced in every phase of spring design and application. They can help you with your spring problems, and release your engineers for other work.
Try it—put your spring engineering problems in our lap. Many satisfied customers will tell you—we've been able to give them better springs and thereby improved their product performance—lowered costs too—through our spring engineering service.
Here at Accurate we've the modern plant and facilities, the spring craftsmen to make your springs the way they should be made . . . and to deliver them when you want them. Call us, today.
. . . we'd like to talk over your spring problems with you
SPRINGS
WIREFORMS
STAMPINGS
Accurate Springs
ACCURATE SPRING MANUFACTURING CO.
3811 W. Lake St., Chicago 24, Ill.

STRAIGHT DOWN THE ALLEY... to your problems!

If the production and maintenance problems of the automotive and aviation industries were pins on a bowling alley, you'd find many you could topple with one ball—"dag" colloidal graphite. The five above are typical.

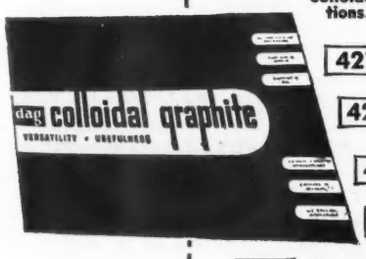
Your problems, too, might topple to that unique combination of properties which gives "dag" colloidal graphite such versatility: slippery, finely divided, soft, resistant to high temperatures, chemically inert, pure, opaque, a good conductor, and capable of permanent adsorption on metal surfaces.

All you need do to probe your possibilities for problem-solving with "dag" colloidal graphite is check below the bulletins which are "down your alley"—or ask for a call from an Acheson technical man.

dag colloidal products

ACHESON COLLOIDS CORPORATION, Port Huron, Michigan

This new literature on "dag" colloidal graphite is yours for the asking:



460 A data and reference booklet regarding "dag" colloidal graphite dispersions and their applications. 16 pages profusely illustrated. ☐

421 Facts about "dag" colloidal graphite for ASSEMBLING AND RUNNING-IN ENGINES AND MACHINERY. ☐

422 Facts about "dag" colloidal graphite as a PARTING COMPOUND. ☐

423 Facts about "dag" colloidal graphite as a HIGH TEMPERATURE LUBRICANT. ☐

431 Facts about "dag" colloidal graphite for IMPREGNATION AND SURFACE COATINGS. ☐

432 Facts about "dag" colloidal graphite in the FIELD OF ELECTRONICS. ☐

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN DEPT. FF-1

JMLooA-F 1

Please send me without obligation, a copy of each of the bulletins checked:

NAME_____

POSITION_____

FIRM_____

ADDRESS_____

ZONE No._____ STATE_____

OUR PRESENT OIL SUPPLIER IS_____

(Lubricants containing "dag" colloidal graphite are available from major oil companies.)

RUST REMOVED
and ONLY Rust!
1 Some chemicals that are used to remove rust do not attack the metal beneath, it is true, BUT—They do not take off the rust either!
2 Other compounds would be very good as rust removers—except that they also remove a large amount of the good steel or iron beneath the rust.
3 NOX-RUST RUST REMOVER, however, satisfies BOTH essential requirements: it removes all the rust AND leaves the sound metal unharmed.

It took long research by skilled chemists in our modern laboratories to develop Nox-Rust Non-Corrosive RUST REMOVER. A scientific blend of active, "wetting" and inhibiting agents, it

(1) Rapidly loosens and dissolves rust
(2) Does not affect critical dimensions
(3) Leaves chemically clean surfaces that make excellent paint bases
(4) Is easily applied by dipping, wiping or brushing
(5) Is long-lasting and economical to use.

USES: Wherever rust has attacked tools, parts, machinery or equipment—and especially on machined precision surfaces such as bearings where close tolerances are held.

Other Nox-Rust products, covering the whole field of metal protection, and engineered recommendations by trained representatives, are available to all industry

Full details on RUST REMOVER and a new catalog of Nox-Rust products will be mailed on request. WRITE TODAY!

SAVES METAL — *Chemicals for American Industry* — SAVES MONEY

NOX-RUST CHEMICAL CORPORATION

2433 S. HALSTED ST. CHICAGO 8, ILLINOIS

British Motor Jubilee

(*Continued from page* 43)

Yet public prejudice against the motor car was difficult to kill and in 1902 there was organized opposition in which the "men of England" were told: "Your birthright is being taken from you by reckless motor drivers who drive over and kill men and women, your children, your dogs, your chickens; they fill your homes with dust; and with dust and stink poison the air you breathe!"

The Motor Car Act that came into force in 1904 increased the speed limit to 20 mph. This regulation, although not strictly enforced, remained on the Statute Book for another 27 years, and introduced the system of driving licenses and the compulsory use of number plates. Britain then had 17,810 motor vehicles in use.

The Rolls-Royce car made its debut in that year, and the prestige of British cars was heightened by a six-cylinder Napier car covering one mile at 104.6 mph. at Daytona.

It was not until the end of 1911 that the very simple runabouts, later to be developed into the light, economical models, made their appearance. The first was the 10 hp Singer. Then came the Austin built by Herbert Austin, who had by this time gone into business on his own account.

In 1912 William Morris, former Oxford cycle repairer, and subsequently Lord Nuffield, produced his first Morris Oxford, competed with it successfully in several motor trials, and laid the foundations of the great Nuffield Organization.

Then came the first European War and under the stress of war great technical developments resulted in the car factories, and manufacturers learned something of mass production methods. And these mass production methods, linked with craftsmanship, in turn enabled the motor car to be introduced to the man in the street to whom, hitherto, the automobile had been an unobtainable luxury.

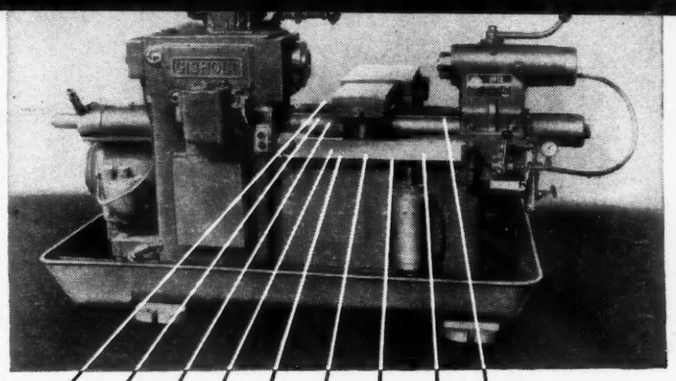
And so the number of motor vehicles in use in Britain grew steadily, from 265,000 in 1914 the total had reached half a million by 1921, and the saloon began to displace the tourer as the popular type of family car. In 1939 Britain's motor vehicle registration reached the 2,300,000 mark.

Its jubilee year sees the British motor industry getting back into its full prewar stride. It looks confidently ahead. Plans have been completed for record export drives and firms are preparing for new high output levels. One group, for example, aims to ship cars and commercial vehicles this year to 79 countries including India, the United States, New Zealand, Africa, the Mid-

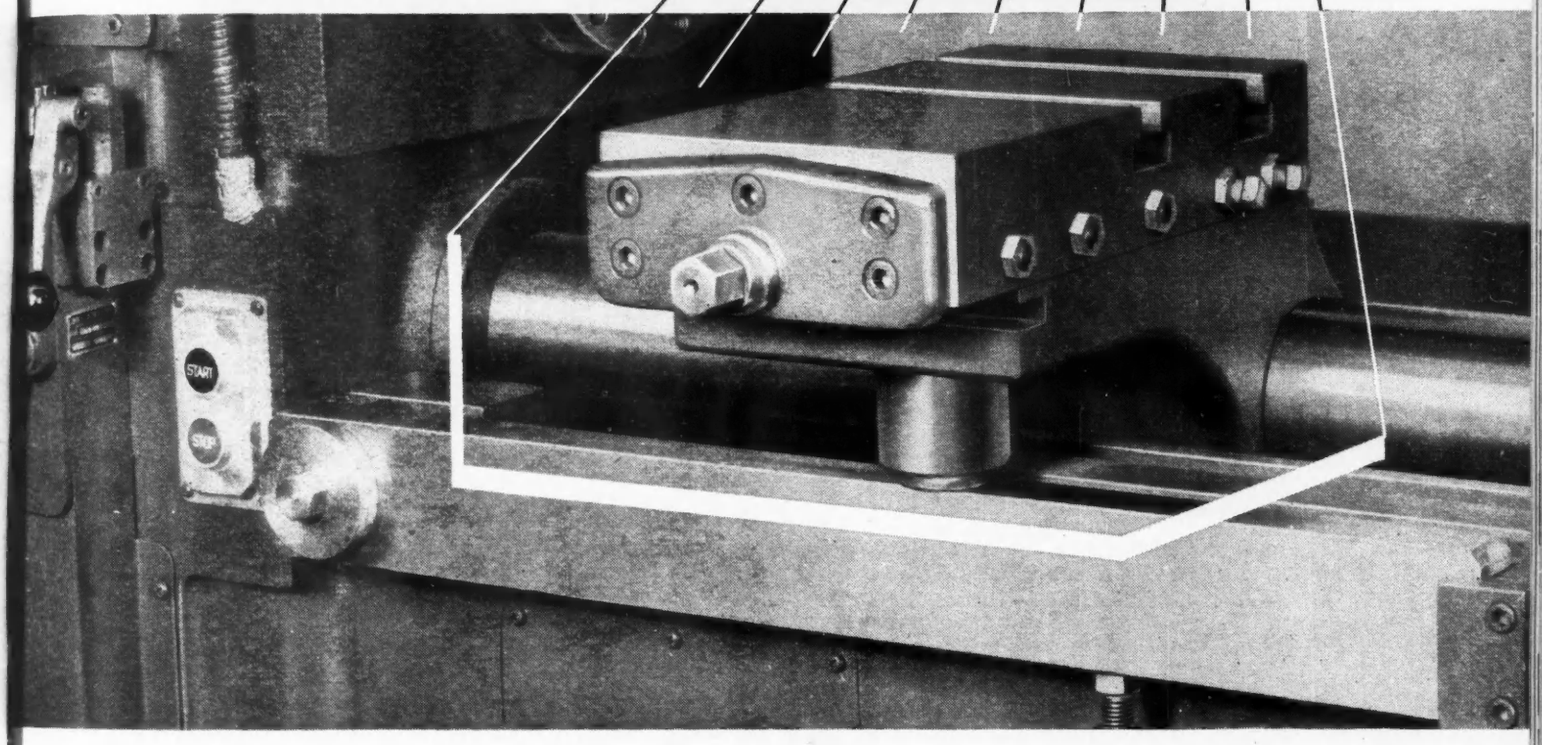
(*Turn to page* 102, *please*)

Why this front carriage is more versatile

Here's one of the many reasons why this machine can perform a number of different machining cycles and handle a remarkably wide range of work for an automatic lathe.



THE GISHOLT HYDRAULIC AUTOMATIC LATHE



The front carriage is clamped to, and receives its longitudinal motion from, a large diameter hardened steel bar along which the carriage may be clamped at any position.

The outer support for the carriage is a hardened steel beam of rectangular section, pivoted at one end and with an up-and-down motion for the other end provided by the piston-cylinder unit on the front of the machine. Raising or lowering this beam imparts a transverse movement to the carriage.

Many combinations of transverse and longitudinal motions can be made at both feed and traverse rates to meet practically every requirement. An angular in-feed attachment may be added for advancing multiple tools into the work at a controlled angle.

With a rear slide which can be placed on the bed table to feed in or out, straight or angularly, you have the combination that means faster, lower cost production on a wide variety of parts. Write for literature.

GISHOLT MACHINE COMPANY

1205 E. Washington Avenue • Madison 3, Wisconsin

Look Ahead... Keep Ahead with Gisholt

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

dle East, Sweden, Spain, Belgium, Holland, and other areas of Europe. Some countries where hitherto British vehicles have been rarely seen will receive shipments—Greece, Costa Rica, Salvador, Paraguay, Ecuador, Sierra Leone, the Belgian Congo, Bermuda, Iceland. It is estimated that the value of these exports alone from this one group is in the neighborhood of £7,500,000—more than a third of the total shipments from the United Kingdom in 1938.

The war has created unprecedented industrial prosperity in many overseas countries, with a consequent improvement in road communications, and created new markets for the medium-sized high performance, economical cars.

British motorcycles and autocycles, the latter of the type used so effectively by airborne troops during the war, are in great demand from the overseas markets. Typical of the experience of Britain's motorcycle manufacturers in this respect is that of the managing director of one company who, after a recent trip to the United States, came back with a list of 80 appointed agents and an initial order for £100,000 worth of 100 mph twin-cylinder sports machines.

While a car-hungry world provides overseas markets that have been described by one manufacturer as "economic vacuums," it is difficult to assess the business which can be done in the British home market. But if only half a million of the vehicles in use in 1939 need replacement after six years or more of hard running (the British motorist is only now able to order a new model for the first time since 1939) and the cost is only £200 per unit, this means a potential business to the tune of £100 million.

So it is indeed with great confidence and high hopes for the future that the British motor industry, with its world-wide reputation for engineering skill, reliability and craftsmanship, enters upon its jubilee year.

Johnson
SELF ADJUSTING HYDRAULIC
TAPPETS
Provide silent valve tappet performance for automotive, truck, tractor, marine, diesel and aircraft engines.
Proven for long-lasting, dependable, trouble-free service.
Made in all steel, all cast iron (chilled face) or combination of steel body with chilled iron face.
JOHNSON PRODUCTS, INC.
"Tappets Are Our Business"
MUSKEGON, MICHIGAN

Abstracts of SAE Meeting Papers

(*Continued from page* 39)

struction and rear drive is employed.

A number of experimental bodies have been built in Germany on the Mercedes-Benz chassis which has a wheelbase of 112 in., track of 52 in. and mounts a 104 cu in. four-cylinder engine with a bore of 2.9 in. and a stroke of 3.94 in. This engine develops 38 bhp at 3200 rmp. The car in standard form is capable of 68 mph and with aerodynamic body, 80 mph. This increase of 17½ per cent in maximum speed is equivalent to a drag reduction of 40 per cent, and using an overdrive gear, this car will give 40 miles per gallon at a sustained speed of 60 mph.

A newly introduced British car, the Healey (see May 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES) has a 146 cu in., four-cylinder engine with a bore of 3.17 in. and a stroke of 4.73 in. The car weighs approximately 2300 lb and the gearing is 22.2 mph at 1000 rpm. It is estimated that with 100 bhp this car will slightly exceed 100 mph. Despite the comparatively high power output, it is a small car by U. S. standards since the wheelbase is 102 in. and has a track of 54 in.

A B.M.W. car (see May 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES) was constructed of a size comparable with normal U. S. products with a wheelbase of 118 in. and a track of 55 in. The engine of six cylinders has vertical overhead valves, a bore of 3½ in. and stroke of 3.9 in., giving a capacity of 211 cu in. The power output is 90 bhp which gives a maximum speed of 90 mph on a high gear which prevents the engine reaching peak of the power curve, the overall ratio giving 28 mph at 1000 rpm. Geared for full available, the maximum speed is 107 mph. Fuel consumption figures on this car are 29 miles per gallon at a steady 60 mph, and 23 miles per gallon at a steady 85 mph, with the engine developing 50 and 85 per cent of maximum mep respectively at these speeds.

SINEWS OF STEEL

FOR DETROIT'S INDUSTRIAL GIANT

By the carload, by tons and thousands of tons, steel from the mills of Great Lakes Steel Corporation feeds the great automotive plants that have made Detroit the Motor Capital of the world.

Here it is transformed through the miracle of modern engineering and mass-production techniques into cars, trucks and buses: A sheet of steel becomes a beautifully designed, smoothly contoured body; formed sections are welded into a sturdy, rigid frame; fenders are blanked and drawn to shape; scores of parts fabricated and heat-treated from the steels that Great Lakes produces for Detroit's own industrial "giant."

Great Lakes Steel Corporation takes great pride in its assignment as a major steel supplier to the automotive industry. On this Golden Jubilee, we join in acclaiming the vision that "put the world on wheels" . . . the vision that has provided greater value in motor cars and vehicles, year after year, since the first car drove the streets of Detroit.

GREAT STEEL FROM GREAT LAKES

GREAT LAKES STEEL CORPORATION

DETROIT 18, MICHIGAN • OFFICES IN PRINCIPAL CITIES

UNIT OF NATIONAL STEEL CORPORATION

Project to Study Social Effects of Aviation

Widely diversified forces of business and education have combined with government officials to launch Air Affairs, Inc., the world's first international project to study and predict the social effects of aviation.

Charles F. Kettering of General Motors Corp., H. J. Symington of Canadian National Railways, and A. F. T. Cambridge, chairman of Govan Bros. in India, are among more than 100 individuals and 40 companies throughout the world who have created the International Journal of Air Affairs, focal point of the project.

Robert L. Clarkson, chairman of American Express Company, J. Bento Dantas, president of Servicos Aereos Cruzeiro do Sul in Brazil, Per Norlin, president of Swedish Intercontinental Airways, Dean James M. Landis of the Harvard Law School, the Shell Oil Co. and Lehman Brothers also are in the original group of sponsors.

Assistant Secretary of Commerce William Burden is chairman of the board of trustees of Air Affairs, Inc., a non-profit corporation publishing the International Journal of Air Affairs. William D. Pardridge of Chicago and Washington, D.C., organized the institution and is president and editor. Stuart S. Ogilvie, vice president of the Second National Bank of Washington, D. C., is treasurer.

REDUCE
RUNOUT
With
MECHANICS
Roller Bearing
Universal Joints
The slip-on-the-transmission-shaft feature which permits both MECHANICS Roller Bearing UNIVERSAL JOINTS to be welded to the tubular shaft, reduces runout, lost motion, excessive play and whip to a minimum. Let our engineers show you how this and other MECHANICS features will help give your product competitive advantages.
MECHANICS
MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner
2020 Harrison Avenue, Rockford, Ill. Detroit Office, 7-234 G. M. Bldg.

General Motors Hits Ceiling, But in Different Way This Time

It appears that the American automobile has got under the skin of everyone, no matter what color that skin may be. General Motors representatives on the floor of the lobby show room in the General Motors Building in Detroit tell of some Mexican buyers who appeared there armed with drafts on New York banks. They offered fantastic prices for all cars on the floor. Bids ranged up to $7000 for a Cadillac, $5000 for a Buick, and similar stratospheric figures for other lines. They were curtly told that G.M. sold no cars there, and in any event would have no part of such a deal. It is reported in trade circles in Detroit that one large automobile dealer lost his franchise for making Mexican deals at prices far in excess of legal ceilings.

Cleveland Graphite Bronze Expands Facilities

As part of its expansion program, Cleveland Graphite Bronze Co. has purchased a former war plant at Fort Wayne, Ind., for the manufacture of automotive bearings and bushings. The company will install special equipment, including a strip mill for making steel strip, as soon as possible. The purchase includes a factory with 42,500 sq ft of floor space and 2768 acres of land with railroad siding.

Truck Tire Prices Break From Ceilings

For the first time since the beginning of the war, prices of truck tires are reported to have broken away from OPA ceilings. A report from New York states that some independent dealers there have slashed prices on certain large slow moving sizes by as much as 15 to 20 per cent. They say that inventories in these categories have become unbalanced and that a buyer's market again exists.

Advertising Note

T. Seward Burrowes, 1st Lt. U. S. Marine Corps, recently returned from active combat duty in the Pacific with the 4th Marine Division, has joined the J. M. Reilly Advertising Agency in Boston. With the J. M. Reilly agency, Mr. Burrowes will be copy director and account executive.

W. A. Givens

W. A. Givens, 60, executive vice president and director of Allegheny Ludlum Steel Corp., died May 29, in Allegheny Valley Hospital, Tarentum, Pa.

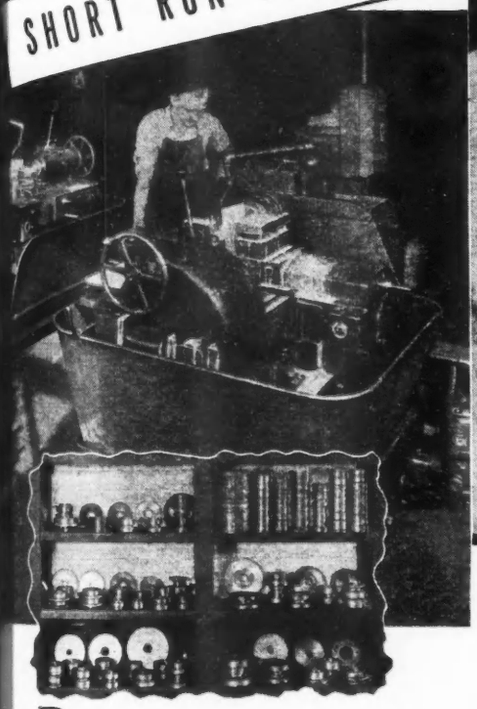
How to apply Multiple Tooling and Automatic Cycling to TURNING JOBS

Whether your turning problem is a mass production job running into thousands of pieces . . . a short run of as few as 25 pieces . . . or a special turning job, Sundstrand engineers will show you how it can be handled to advantage on automatic lathes with quick cycle changeover. They will also assist in designing the most profitable processing method for the job at hand.

All of the advantages of multiple tool turning are available for both short run and mass production work with Sundstrand lathes. When the nature of the work is such that these standard automatic lathes cannot be tooled to handle the part, our engineers recommend and design special automatic lathes.

Described here are three typical cases in which Sundstrand "Engineered" Production assisted plant engineers in designing a tooling method which resulted in lower turning costs.

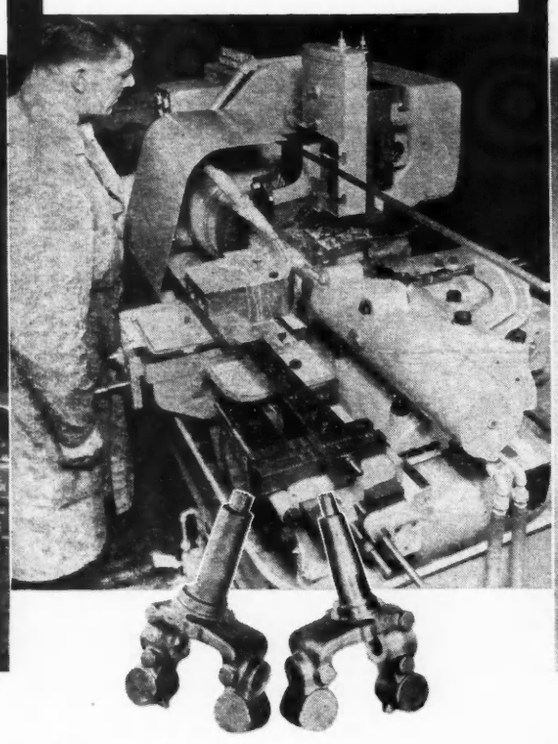
1 SHORT RUN TURNING



DUE to the quick changeover features of the Sundstrand automatic cycle, it is possible for this manufacturer to turn many of his jobs in lot sizes as low as 25. On one lot of 40 sleeves, his turning time was cut from 50 to 7 hours. Over 100 different parts are turned, including sprockets, pulleys, gears, etc., with lot sizes of 25 to 100 pieces.

Universal tool blocks, for adjusting tools to handle wide range of parts, keep tooling inventory to a minimum.

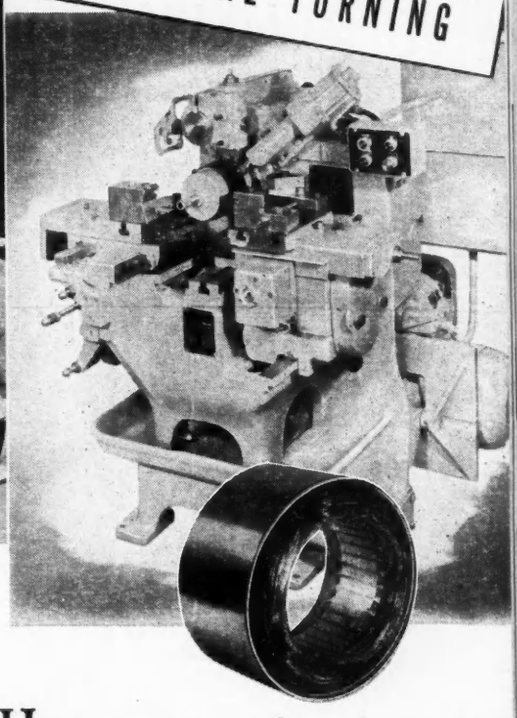
2 LONG RUN TURNING



SUNDSTRAND'S unique cycle control mechanism is remarkably simple and easy to adjust, Consequently, the time saved in setting up the machine is also desirable for turning long runs. Here's an example:

Six different steering knuckles are rough turned on this Sundstrand Model 12 Automatic Lathe. Operations include both straight and taper turning, facing and chamfering. With two complete sets of tool blocks, all parts are machined with a minimum of changeover time. Nine tools completely rough the stem end of the part in one machine cycle.

3 SPECIAL TURNING



HERE'S a special Sundstrand lathe which bores the I.D. of both ends, chamfers the I.D. and O.D. of both ends and faces the ends of a stator frame and coil assembly. Eight tools are used in this setup to complete the operation in one machine cycle. Machine and tool adjustments enable this equipment to be used on a number of different sizes of parts. A special short bed was provided so that operator position is convenient for loading, unloading and starting machine cycle.

MORE TURNING FACTS *Free*

This 44 page booklet, crammed full of technical data and production information shows how to apply multiple tooling to countless turning jobs. Short-run, mass production and special turning jobs are all included. Write for your copy today. Ask for bulletin 240.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

SUNDSTRAND MACHINE TOOL COMPANY

2571 Eleventh Street, Rockford, Illinois, U. S. A.

RIGIDMILLS • AUTOMATIC LATHES • SPECIAL MILLING AND TURNING MACHINES

CLEANED
and CONDITIONED
METAL SURFACE
Certified
FOR DURABLE
LUSTROUS FINISH
CHEMICALS
ACP
PROCESSES

ACP CHEMICALS
PROPERLY CLEAN
and PREPARE
METAL SURFACES for
ORGANIC FINISHES
Prevent paint failures
Minimize rejects
Assure enduring
lustrous finishes

COLD SPRAY-GRANODINE produces a dense smooth zinc phosphate coating that protects steel and paint for a durable, lustrous paint finish.

THERMOIL-GRANODINE creates a heavy coating of iron and manganese phosphate which when oiled retards corrosion and prevents excessive wear on friction surfaces. When painted provides unusual protection.

DURIDINE 210 B (formerly 210 B Deoxidine) assures proper cleaning and a thin, tight and relatively hard phosphate coating so essential to a bright enduring paint finish.

DEOXIDINES — Phosphoric acid metal cleaners. Remove rust and rusters and prepare metal surfaces properly for lasting paint finish.

LITHOFORM — a phosphate coating that bonds paint to galvanized, zinc or cadmium coated surfaces.

American Chemical Paint Co.
AMBLER ACP PENNA.

New Products for Aircraft

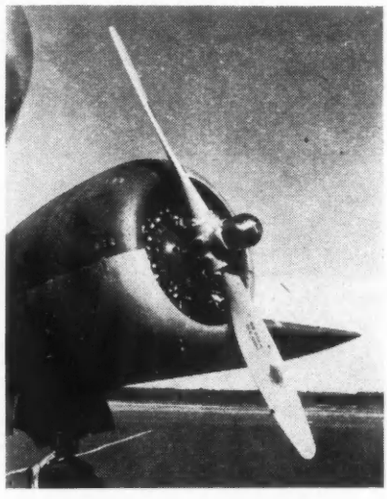
(*Continued from page* 48)

Where two or more storage tanks were once needed to meet airport demands, only one will now be needed to supply all light plane gasoline. Octane requirements of both prewar and postwar models of personal-type planes are met by Texaco 316, since most prewar models require a 73-octane fuel, and most postwar models call for 80-octane fuel.

Smaller Version of Hydromatic Propeller

A smaller version of the Hydromatic propeller has been placed in quantity production by Hamilton Standard Propellers division of United Aircraft Corp., East Hartford 8, Conn. The new model is designed for twin-engine aircraft in the feederline, private and executive category.

The same quick-feathering characteristics and wide range of constant speed operation which identified the larger Hydromatic types are available on the "junior" model. Generally suited for aircraft ranging in passenger capacity from four to 20, it is used primarily on engines of from 450 to 600 hp.



Hydromatic propeller

Ranging from eight ft three in. to ten ft in diameter, the small Hydromatic is said to be virtually unchanged in design from the propellers of up to 16½ ft across that equip today's airliners. The blades are of light weight duraluminum alloy.

Photograph Container for Air Mailing

The recent initial flight of Northeast Airlines between Worcester and New York carried unique new aluminum photo-containers for air-mailing. These

(*Turn to page* 108, *please*)

You Get
BETTER PAINT
GRIPPAGE
When You Use
OAKITE
CrysCoat
REG. U. S. PAT. OFF.
PROCESS

This outstanding war development made possible by Oakite CrysCoat Process, has a wide application on peace-time products fabricated from steel or iron to which paint or similar organic finishes are subsequently applied.

In ONE low-cost, time-saving operation, Oakite CrysCoat Process removes light oils, grease and shop dirt, imparts a microscopic crystalline coating to steel or iron surfaces which prevents rusting and at the same time provides excellent, firm grippage for paint.

FREE Service Report Gives You All Details

Safe to product and the equipment in which it is used, Oakite CrysCoat Process is economical to use, speeds production, eliminates paint adhesion failure due to incorrect surface preparation. Write for FREE Service Report giving essential details.

OAKITE PRODUCTS, INC.
28A Thames Street, New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* CLEANING
MATERIALS • METHODS • SERVICE

When Farmers Wished They'd Planted Oil Wells

ONCE UPON A TIME many years ago—and this is no fairy tale—thousands of farmers who bought a well-known make of tractor found that the engines in those tractors started to pump oil before the guarantee-period was over—in too many cases, *before it was half over!*

It was apparent at once that the trouble was in the piston rings. So the tractor manufacturer called in the leading makers of piston rings, explained the problem, and asked for a solution.

Only Pedrick found the right answer. Pedrick engineers went right to work on the problem and came up with a ring that really stopped the oil-pumping—a ring that more than *tripled* the previous service-record of the tractors.

Ever since then, this make of tractor has used *Pedrick piston rings.* This is typical of the engineering skill that Pedrick applies not only to tractor problems, but to automotive, Diesel, aircraft, and all other piston ring applications . . . whether for original equipment or replacement service. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

Pedrick

precisioneered
PISTON RINGS

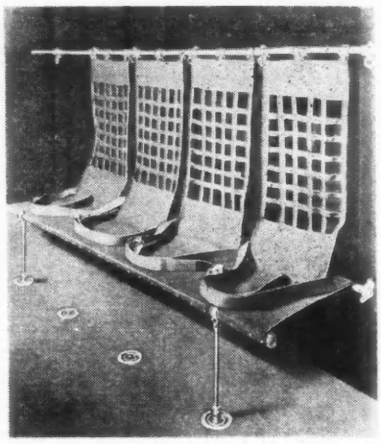
were devised by the Howard-Wesson Advertising Agency, 50 Portland St., Worcester 8, Mass.

The agency's business involves mailing valuable photographs and retouched photographs that require protection for safe delivery. As an answer to the problem, the new device was created. It consists of thin sheets of aluminum which are sealed with viscose tape. The rigidity of the aluminum, plus the moisture proof aspect of sealing, gives this container a distinct advantage over the conventional cardboard, and affords complete protection against bending, rough handling and weather. The container was developed in conjunction with the Worcester Stamped Metal Co., 9 Hunt St., Worcester 4, Mass.

Seats for Cargo Planes

Evans Products Co., 15310 Fullerton Ave., Detroit 27, Mich., is introducing folding seats, known as Sky Seats, for use in cargo airplanes.

Sky Seats are manufactured in two, three and four-man models and can be installed in any combination in any cargo airplane. Construction is of metal tubing and canvas, designed for maximum strength with minimum weight. The four-man seat weighs but 22 lb. Safety belts, tested to meet United States Army specifications, are furnished with each seat.

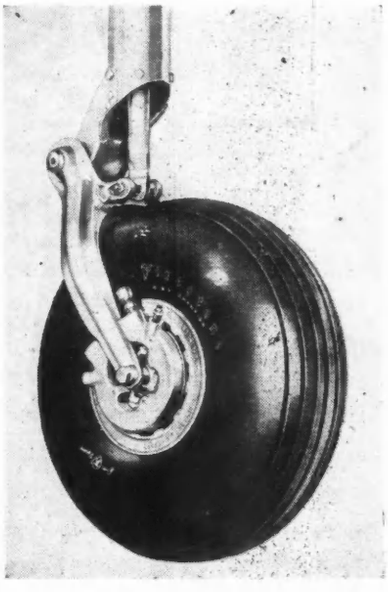


Evans sky seats

The seats are designed to use a minimum of space, making it possible to carry both cargo and passengers comfortably on the same flight. To make maximum use of the airplane's cargo space, the Sky Seats are folded back along the sides of the airplane.

Package Landing Gear

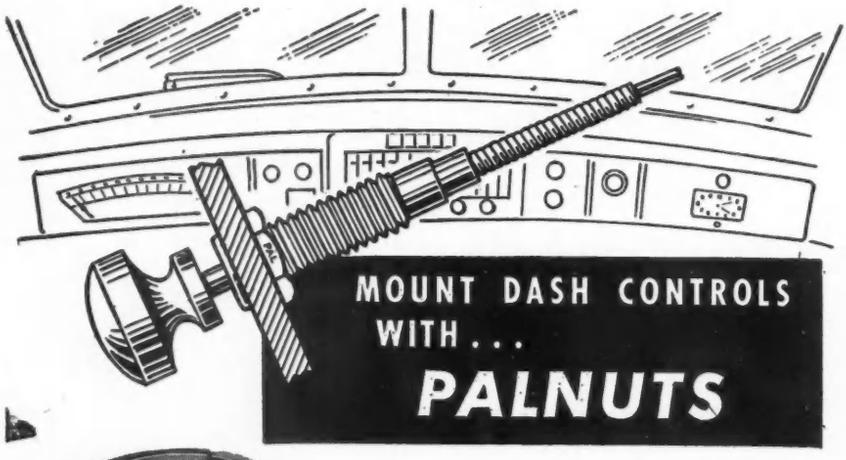
A package-unit undercarriage with a lightweight shock absorption unit is being made available for all aircraft weighing less than 3,000 lb by Firestone Aircraft Co., Akron, Ohio.



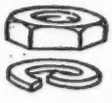
Firestone SuperFlex undercarriage

A spring-like rubber cylinder of the shock absorption unit, filled with compressed air, cushions the initial impact of landing. Rings of friction material then act as brakes in restricting any bouncing tendencies. In the landing gear, there are no telescoping tubes, no oil valves or compartments, no packing glands. Dust and dirt are said to have no effect on the operation of the Super-Flex unit.

(*Turn to page* 110, *please*)



• FASTER ASSEMBLY
• LOWER COST
• ABSOLUTE SECURITY

Handle ONE part instead of TWO 

When you mount controls on the dash of your cars, you want them to remain tight in service. Self-locking Palnuts do this job unfailingly—and you only have to handle one inexpensive part to achieve it.

As a result, Self-locking Palnuts save in material cost and in assembly cost, while giving you a vibration proof assembly.

Available in a variety of sizes, covering the most popular control bushings. Send for free samples. Literature on request.

THE PALNUT COMPANY, 60 Cordier St., Irvington 11, N. J.

Self-Locking PALNUTS

TESTING MACHINES NEED

Calibrating?

Here's a BALDWIN SERVICE to help you . . .

How long since you have had your testing machine calibrated? You'll probably find that a check-up is a good investment.

The Baldwin Calibration Service places at your disposal the help of a specially trained engineering staff, and the largest assortment of Morehouse Proving Rings in the country.

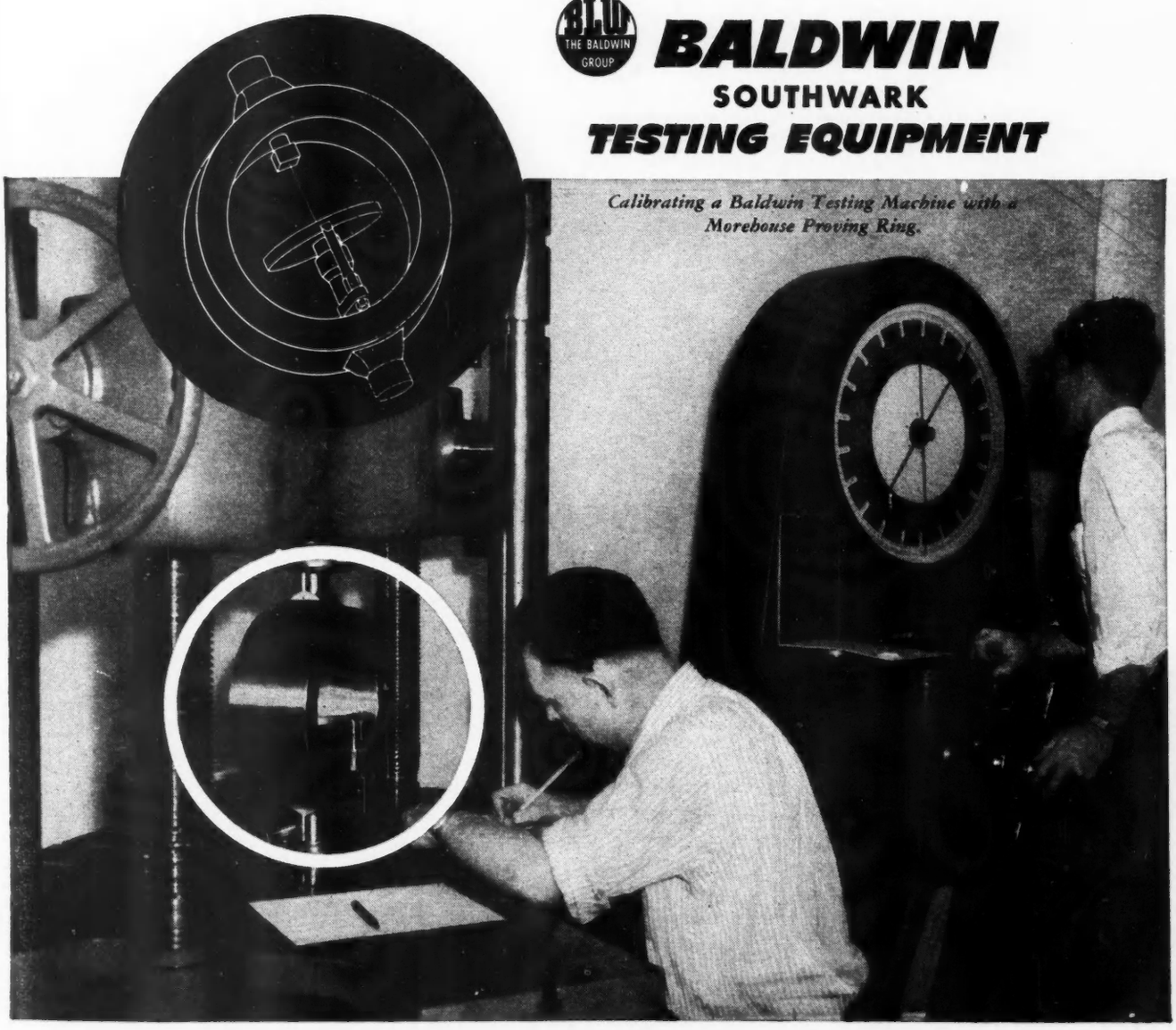
The service can also be used to check scales, measure reactions, and determine loadings in structures and equipment.

Bulletin 186 will give you added information. Write for a copy.

The Baldwin Locomotive Works, Locomotive and Southwark Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, St. Louis, Washington, Boston, San Francisco, Cleveland, Detroit, Pittsburgh, Houston, Birmingham, Norfolk.

BLW THE BALDWIN GROUP

BALDWIN
SOUTHWARK
TESTING EQUIPMENT



Calibrating a Baldwin Testing Machine with a Morehouse Proving Ring.

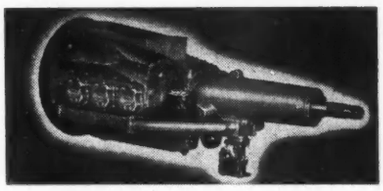
The SuperFlex Undercarriage is a package unit. It includes the landing gear, the tire, wheel and brake. It can be installed easily and replaced quickly. In three sizes, it can fit practically any airplane under 3,000 lb.

New Franklin Engine

A completely new 215 hp engine, known as the Franklin "500," has been developed to power the Republic "Seabee," and is now available for similar submerged or pusher installations in other aircraft, according to announcement made by Aircooled Motors, Inc., Liverpool Rd., Syracuse, N. Y.

The Franklin "500" takes its designation from its 500 cu-in. displacement. It produces its rated 215 hp at 2500 rpm with 80 octane fuel. Complete weight varies slightly with different accessory combinations, but is approximately 485 lb.

Integrally-cooled by a direct-drive fan, and with a special propeller shaft extention which permits the center line of the propeller to be farther aft than normal, the Franklin "500" is a complete packaged power plant, lending itself to an efficient pusher installation.



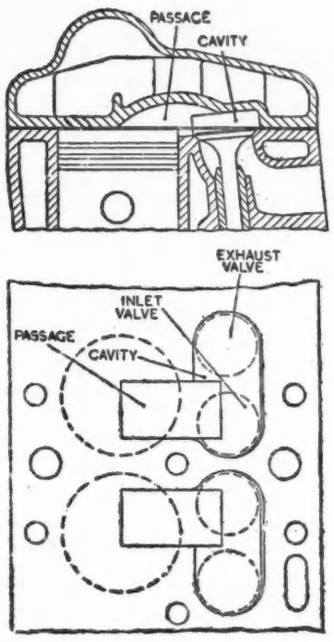
Franklin "500" engine

Basically, the Franklin "500" retains the horizontally-opposed design. The propeller shaft, provided with standard aircraft splined end, is attached to the engine crankshaft and is supported by the propeller shaft housing which forms the extension. This extension also permits a mounting location for the engine accessories. The carburetor, fuel pumps and ignition system are all exposed and readily accessible for servicing.

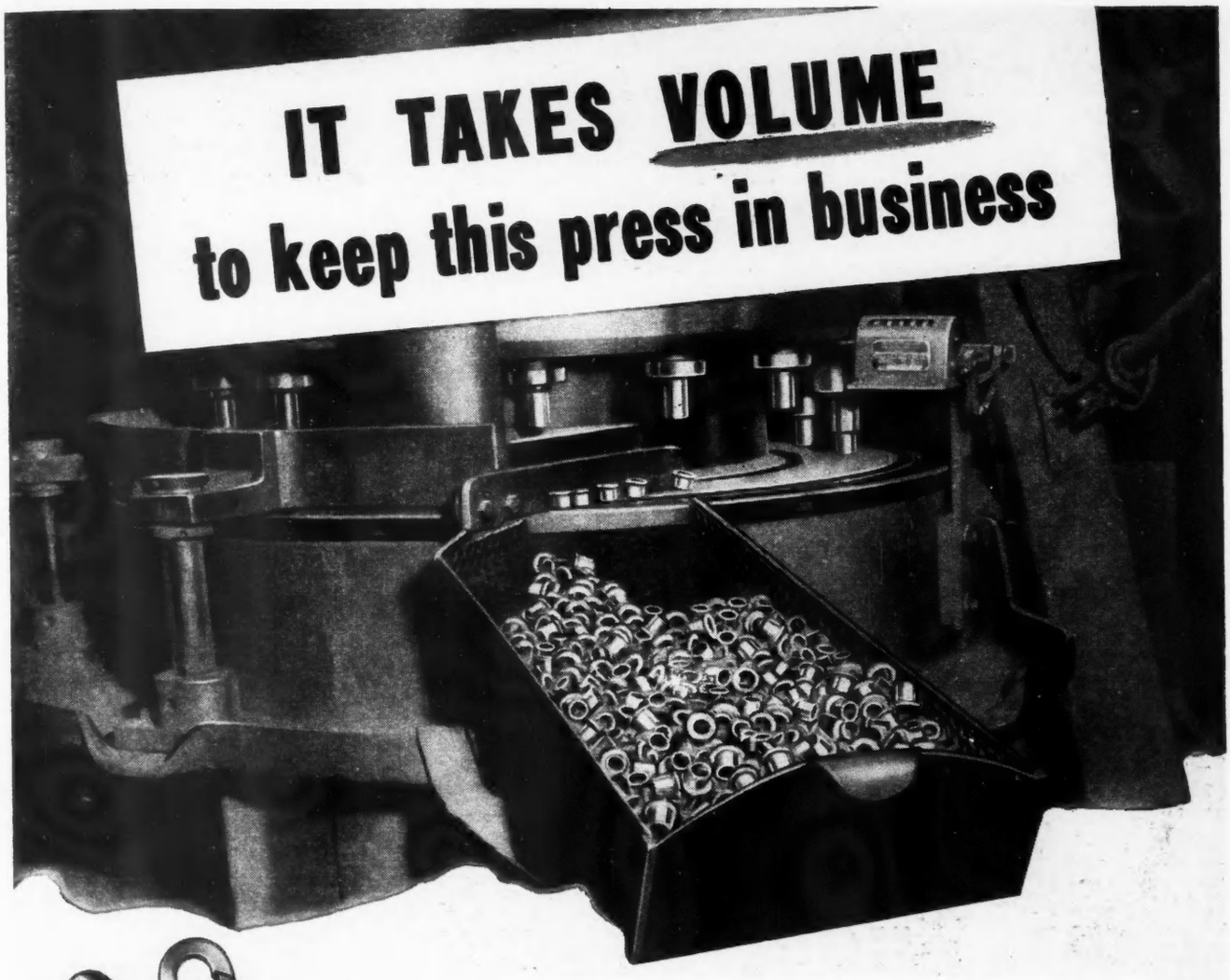
STERLING-
Specialists in Aluminum Permanent Mold Castings
Sterling's modern foundry, patented molding process, quality materials, and expert workmanship have been, for years, producing the finest in aluminum pistons.
This same expert workmanship and patented molding process has enabled us to develop many special permanent mold aluminum castings for the automotive and aviation industries.
Wherever a minimum of finishing and light weight is a factor, our engineers' experience will be of value to you in developing a permanent mold aluminum casting to economically meet your requirements. Call or write
STERLING ALUMINUM PRODUCTS INC.
St. Louis 6, Missouri

New Design of Combustion Chamber

Morris Motors has patented a new type of combustion chamber which permits a higher compression ratio with side valve engines. It consists of two chambers with a cavity extending over each pair of valves, this forms an L. The design gives a relatively narrow passage connecting the inlet valve end of the cavity to the combustion chamber that may be formed wholly on the cylinder head or partially in the cylinder block.



Elevation and plan of new combustion chamber, the design of which has been patented by the engines branch of Morris Motors



Powder metallurgy has "come of age" at Moraine Products.

It has graduated from the "job shop" stage and taken on a mature assignment in the manufacturing operations of our customers.

By demonstrating what *can* be accomplished through powder metallurgy in the economical production of parts for varied industries, Moraine Products has also determined what *cannot* be accomplished economically. And one of the fundamental limitations is based on the fact that powder metallurgy does not lend itself economically to small-run production. The very nature of the tooling and methods required makes large, continuing volume the key to satisfactory pricing and delivery.

Today, metal powder parts from Moraine Products are used in leading makes of household appliances, automotive applications, and varied products which call for practical tolerances, quality and large volume. A broad engineering background and extensive manufacturing experience qualify Moraine Products for this responsibility.

MORAINE PRODUCTS DIVISION OF **GENERAL MOTORS**
DAYTON, OHIO

Airbriefs

(Continued from page 46)

Seabee Production

Republic Aircraft Corp. has released tooling and materials on the basis of a production schedule of 5000 Seabee four-place amphibian private planes this year. Production is planned for 900 per month by early Fall, half-again as large as peak P-47 Thunderbolt production during the war.

Mars Landplane

The Glenn L. Martin Co. is now at work on a giant cargo landplane which will utilize the wing and power plant assemblies of the 72-ton Mars flying boat. The huge plane is under development for the AAF and as a troop carrier will accommodate 136 fully-equipped infantrymen over a range of 2000 miles.

144 mph Helicopter

A new model of Bell Aircraft Corp.'s two-place Model 47 attained a top speed of 144 mph during recent speed run tests. Lawrence D. Bell believes this a significant indication of the helicopter's speed potential, a characteristic undeveloped to date. The Bell five-place Model 42 will be flying this Fall.

The Pioneer

Northrop Aircraft, Inc., has another radical aircraft now in the design stage. The Pioneer, as it is known tentatively, is said to be a tri-motor cargo transport plane. It is not of the flying wing type.

Globemaster Tests

The giant Douglas C-74 Globemaster is now at Wright Field, Dayton, Ohio, following its first cross-country test from Los Angeles. It will undergo AAF load and performance tests and may be featured in attempts on world's records for speed and altitude with various loads in line with the AAF's announced intention to capture for America as many international aviation records as possible.

Double Windshield

The new Republic XF-12 Rainbow transport is equipped with a double windshield for the flight crew. In the normal position, both windshields are in place and the nose is conical and smooth. Hot air anti-icing space is provided between the two panels. When the going gets tough, however, the forward, or outer windshield is hydraulically retracted down into the fuselage resulting in the familiar notched fuselage appearance of more conventional aircraft.

G. W. 160 Tons

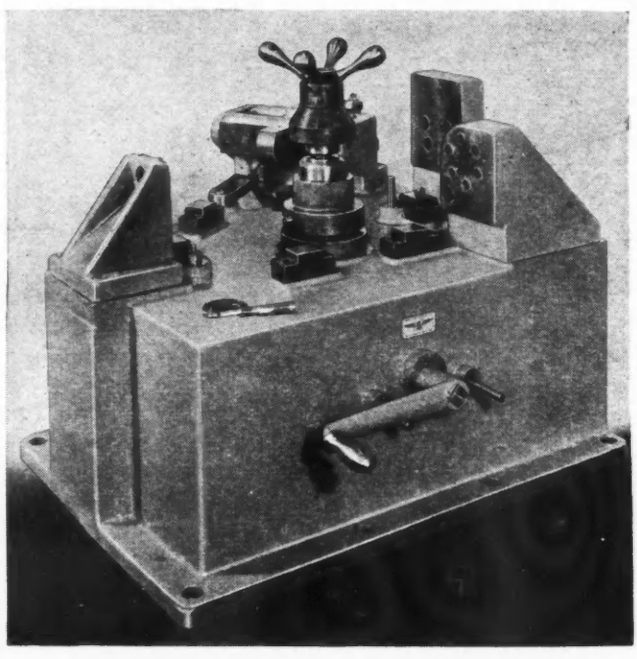
Gross weight of Consolidated-Vultee's monster XB-36 six-engined bomber has been increased 20 per cent to 160 tons by engineering design changes. Total power output will be 22,000 hp, about three times that of the largest locomotive. It is expected to show a cruising speed of 320 mph at 40,000 ft. First flight test is scheduled for Summer, 1947.

GAGES • JIGS and FIXTURES

Designed and Produced to Your Order

● In the design of special tools, gages, jigs and fixtures for expediting and controlling production, MERZ engineers approach each problem from *two* directions: *first*—from the standpoint of guaranteed accuracy, *second*—from the standpoint of simplicity, and facility of operation.

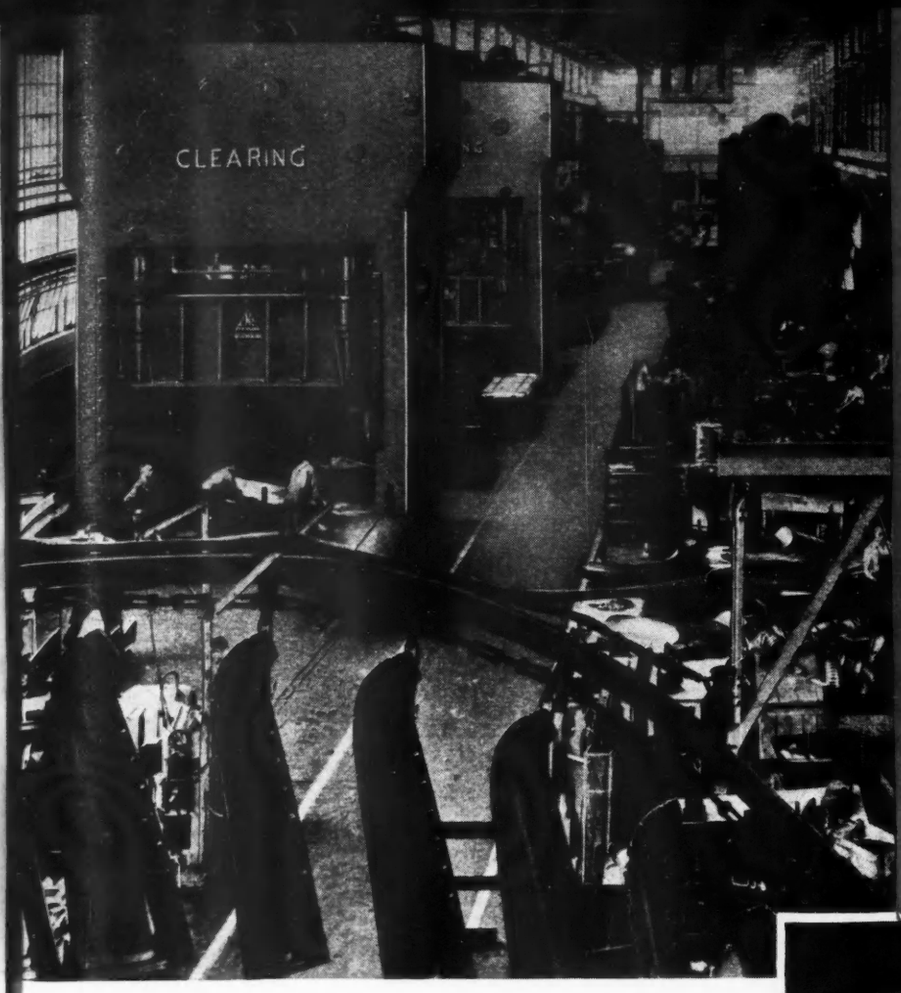
When you commission MERZ to design and build your special fixtures and gages you are assured of equipment for maximum quality and quantity of production. Write for literature describing our skill and facilities in this highly specialized field of engineering service. Prompt shipment of MERZ standard A.G.D. gages, from stock.



We are specialists in the design and production of experimental machines and devices

MERZ *Engineering Company*

INDIANAPOLIS 7, INDIANA



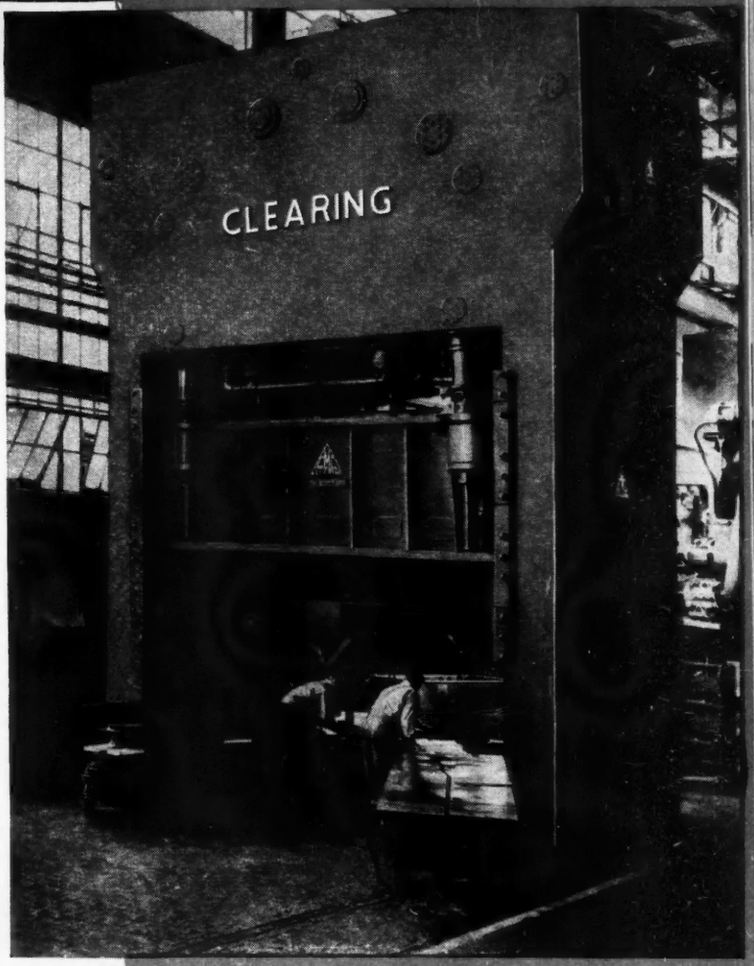
CLEARING PRESSES for stainless steel

Clearing Press Precision for hard-to-work metals

To work materials like stainless steel, Clearing Presses provide the two essentials for successful operation: (1) Smooth flow of power to the slide and (2) proper suspension of the slide to maintain exact alignment of dies under all conditions. The double-action, 1200 ton capacity Clearing Mechanical Presses illustrated here are used for a variety of jobs in drawing and blanking stainless steel. This has included such relatively large parts as drawn and formed sections for bus and diesel truck fuel tanks and locomotive water tanks.

Clearing mechanical press features such as eccentric drive, double guided slide, air clutch and brake assembly, and welded steel construction combine to give unusual press rigidity, extreme smoothness in power transmission and accurate maintenance of die alignment.

Clearing engineers will be happy to analyze your requirements in press equipment at any time. Clearing Presses, either mechanical or hydraulic, can be supplied in any size or type for every production demand.



Photographs Courtesy of Heintz Manufacturing Company, Philadelphia

CLEARING MACHINE CORPORATION

6499 West 65th Street **Chicago 38, Illinois**

OFFICES . . . CHICAGO . NEW YORK . CINCINNATI
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CLEARING MECHANICAL AND HYDRAULIC PRESSES

CMC CLEARING

for FORMING . DRAWING . BLANKING . FORGING

also Pneumatic and Hydropneumatic Die Cushions . Automatic Feeds . Accumulator Systems

Engineered for the Job

2 drafting room techniques

that save time, labor, and dollars in the office!

Ever stop to think why a Draftsman *always* draws on translucent paper?

It's done so that reproductions can be made quickly in an Ozalid machine, or in blueprint or similar equipment.

In these units, light rays penetrate the original, exposing sensitized paper beneath. Then, the print is developed.

Opaque originals cannot be reproduced in this economical manner. They must be copied photographically—and, by comparison with OZALID'S unique Dry-Development, this takes 65 times as long! And you receive only a negative —not a positive!

No wonder leading companies have changed to translucent forms . . . so that Ozalid could be utilized in all departments as well as in the Drafting Room!

1. Use translucent paper for office forms, reports, stationery.

Then, whenever you want reproductions, you can get POSITIVE OZALID PRINTS IN AS LITTLE AS 9 SECONDS!

Besides being the fastest technical reproduction process, OZALID IS THE MOST VERSATILE—allowing you to make 10 different types of prints; in different colors—black, blue, maroon, or sepia; and on different materials —paper, cloth, foil, or film.

Each type of OZALID PRINT has its advantages—you use the one best suited for the job at hand.

2. If originals are opaque, make a translucent "Master."

A positive film "MASTER" can be made from *any* opaque original in the usual photographic steps. This is used to turn out subsequent OZALID prints in seconds, at negligible cost. Then it can be filed away until more prints are needed.

Continuous-tone photographic material is reproduced this way. Also, advertising posters and direct mail folders prepared on opaque material.

See samples of the 10 types of OZALID PRINTS and learn the whole story. Write today for free booklet 54.

OZALID

DIVISION OF GENERAL ANILINE AND FILM CORPORATION
JOHNSON CITY, NEW YORK
Ozalid in Canada—Hughes Owens Co., Ltd., Montreal

Instrument cluster panel
1946 Packard

"Ask the man who owns one"

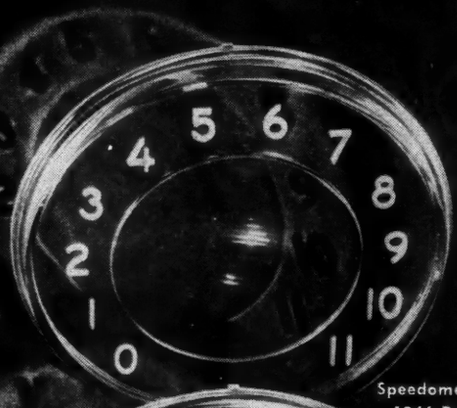
how he likes the DU PONT "LUCITE" in his 1946 Packard

Functional beauty—in materials that are not just "trimmings," but materials that do their job . . . that's what the American automobile buyer wants in his car. That's precisely what he gets in Du Pont "Lucite" acrylic resin. You'll see what we mean when you judge the '46 Packard.

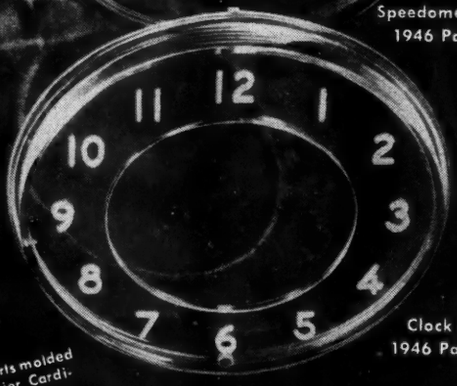
"Lucite" transmits 90% of the light rays... that assures clarity. "Lucite" resists sunlight and weathering . . . *that* assures clarity years from now. The ability of "Lucite" to "edge-light" makes it doubly practical on the dashboard.

"Lucite" means beauty. "Lucite" means performance. "Lucite" means mass production through its ability to be readily and rapidly molded. Write for booklet, *Heat-Resistant "Lucite."* E.I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 206, Arlington, N. J.

Horn button
1946 Packard



Speedometer dial
1946 Packard



Clock dial
1946 Packard

These parts molded by: Hoosier Cardinal Corp., Evansville, Ind., Chicago Die Mold Corp., Chicago, Ill., Plastic Molders, Ind., Chicago, Ill., and Michigan Molded Plastics, Dexter, Mich.

YOU'LL FIND "LUCITE" ON THE NEW CARS BECAUSE:

- **"Lucite"** has outstanding resistance to sunlight, to many chemicals, to "weathering".
- **"Lucite"** has a favorable strength-weight ratio.
- **"Lucite"** is crystal-clear, and is made in a variety of colors.
- **"Lucite"** has good shatter-resistance, good tensile and flexural strength.
- **"Lucite"** has the remarkable property of "edge-lighting".

First choice on leaders of the highway—DU PONT "LUCITE"

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

A MESSAGE TO THE AUTOMOTIVE & AVIATION INDUSTRY

10 BIG ADVANTAGES OFFERED INDUSTRY IN THE "UNION PACIFIC WEST"

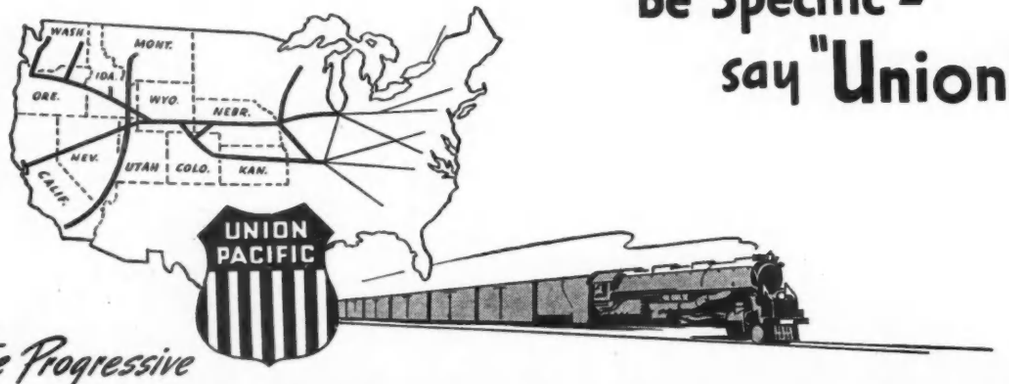
1. AVAILABILITY OF RAW MATERIALS
2. ADEQUATE SOURCES OF POWER
3. OPPORTUNITY FOR DECENTRALIZATION
4. NON-RESTRICTIVE LEGISLATION
5. LARGELY NATIVE-BORN LABOR AVAILABLE
6. HEALTHY LIVING CONDITIONS
7. GOOD SCHOOLS
8. GROWING CONSUMER MARKETS
9. INCREASING INDUSTRIAL DEVELOPMENT
10. FAVORABLE DISTRIBUTION FACILITIES*

*

Union Pacific—the Strategic Middle Route—unites the East with the Mid-West, Intermountain and Pacific Coast states.

It has facilities and equipment designed to meet industry's heaviest demands. Trained traffic men offer a helpful, cooperative service to all shippers.

For information regarding western industrial sites, write W. H. HULSIZER, General Manager of Properties, Department 101, Union Pacific Railroad, Omaha 2, Nebraska.



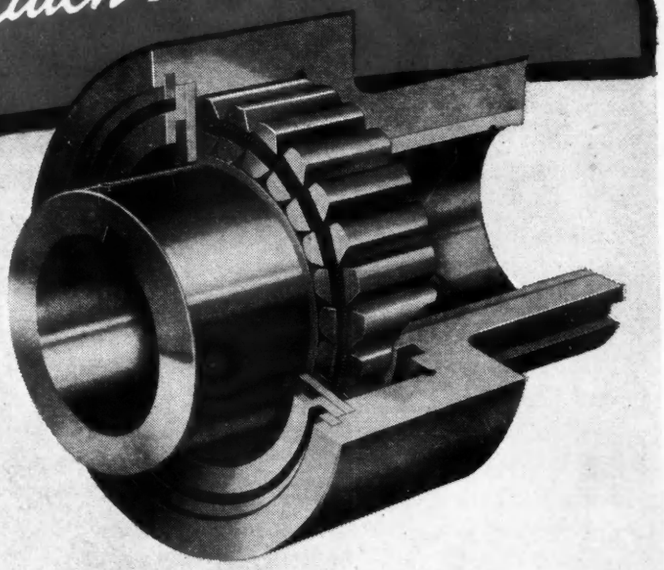
be Specific – say "Union Pacific"

The Progressive

UNION PACIFIC RAILROAD

The Strategic Middle Route

High Torque Capacity in a SINGLE UNIT with FORMSPRAG *the* FULL COMPLEMENT *Over Running Clutch ..*



Formsprag Design Insures SUPERIOR PERFORMANCE

The performance of FORMSPRAG, in widely diversified industries, offers testimony to Gear-grind's sound engineering, precision manufacture and proper application.

Full Complement of Sprags

With the annular space between driving and driven members *completely filled* with sprags, there is no need for cages to position them. Torque load is distributed over the greatest possible number of sprags. Longer life is the result.

High Torque Capacity

Formsprag is available in many sizes, providing torque load capacities from 20 to 10,250 foot pounds. Formsprag offers the highest possible capacities for size, weight and space required for installation.

Simple Construction

Cylindrical inner and outer races on which no localized wear can develop. No internal or external cams. No cages. End notches shaped to retain energizing spring and protect sprag gripping surfaces against concentrated end load. Easy installation.

Positive, Instantaneous Action

No lost motion. No backlash. No slipping. Over-runs freely, at the slightest reduction in the speed of the driving member. Engages smoothly and positively.

Write for Literature

Upon request we will send you illustrated literature, specification sheets showing capacities and dimensions of both plain and ball-bearing types. To serve you best, let us have a description of your operation, normal and maximum torque at specified speeds, number of times a minute the clutch engages and disengages, space limitations and other pertinent information.

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

On the road to profits

IT'S A PLEASURE to ride in this modern bus. Its luxurious comfort is an important factor in winning traffic and boosting revenue. On the profit side, too, its upholstery can be sitting pretty when older types would be worn out. VINYLITE plastic upholstery wears as upholstery never wore before—and keeps on looking new! It slashes maintenance costs; doesn't crack with age; is unharmed by grease; wipes clean with a soapy cloth.

Fabric coated with VINYLITE Brand plastic compound has an air of richness and harmonizes with every decorative scheme. Colors are practically unlimited. Surface effects include the texture of fine leathers . . . In a truly modern sense, VINYLITE plastic upholstery is a superlative *new* material, with new values of durability and lasting smartness in every upholstery application.

THE HIGH DIELECTRIC STRENGTH OF VINYLITE PLASTIC insulation permits small-diameter construction—a valuable feature for original wire in electric tools and appliances. The thin walls bring light weight, maximum flexibility, and installation ease. Furthermore, this modern plastic is highly resistant to flame, moisture, aging, alkalis, alcohols, solvents, and most acids. It has better heat resistance than former insulation materials. Its wide range of colors—opaque, transparent, and crystal white—is often useful in establishing circuit identification.

SPARKLING COLORS AND EYE-APPEAL. There you've *two* attributes of high gloss elastomeric VINYLITE plastics. And besides transforming drably utilitarian items into attractive, decorative objects, this unique plastic brings new concepts of wear and dependability to the whole range of products associated with mechanical rubber goods. It's non-oxidizing . . . extraordinarily resistant to abrasion, oils, greases, acids, and alkalis. It's non-flammable. The compounds come in four standard durometer hardnesses—60, 70, 80, 90; and they give you the speed advantages of injection molding.

VINYLITE PLASTICS are one of the most versatile groups of material ever made available to industry. They include many varieties of molding and extrusion compounds . . . resins for use in industrial adhesives, and in paper, textile, and surface coatings. They come, too, in various forms for economical fabrication . . . in rigid sheets . . . flexible sheets, sheeting, and films . . . in rods, tubes, continuous fibers and monofilaments. Write Department 15 Y for detailed information about any type of VINYLITE plastics that might improve a product of yours, or effect production economies. Bakelite Corporation field representatives will also be glad to sit down with you and help solve any specific problem.

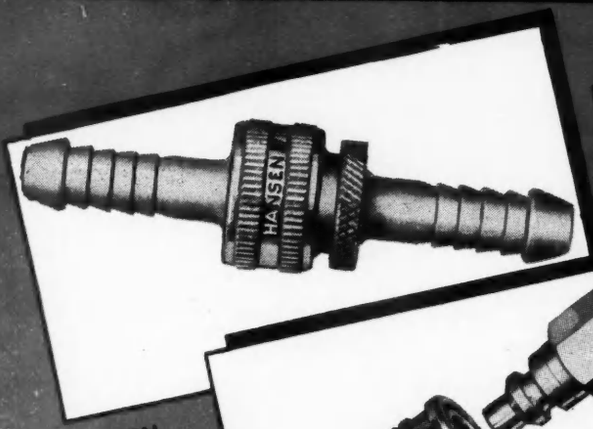
VINYLITE

TRADE-MARK

PLASTICS

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 EAST 42ND STREET, NEW YORK 17, NEW YORK

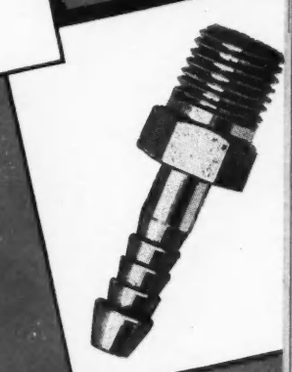
HANSEN



UNION STEMS

HOSE CLAMPS

OXYGEN COUPLING

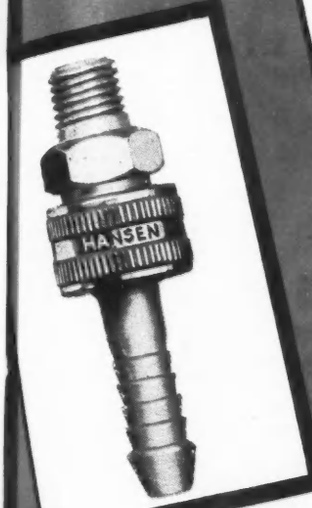


HOSE STEM

Industrial AIRLINE EQUIPMENT

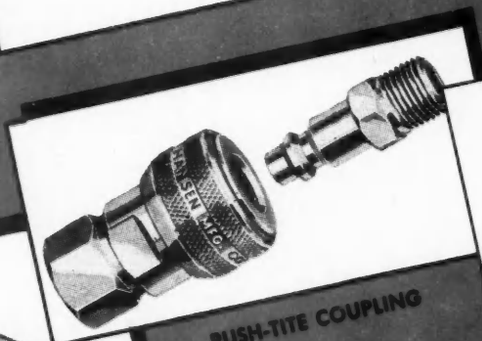
For over a quarter of a century Hansen airline equipment has not only pioneered and paced the field but has acquired an international reputation as the finest "precision made" equipment of its kind.

Our engineers, highly specialized, have had years of experience in creating, designing and introducing to industry new and improved equipment which has met with tremendous success, as is evidenced by the users of Hansen equipment. From the largest industrial plants in the world down to the small ones, you will find Hansen equipment widely used. Hansen equipment has proven its worth, particularly in plants where peak production, economy, time and labor savings are essential.



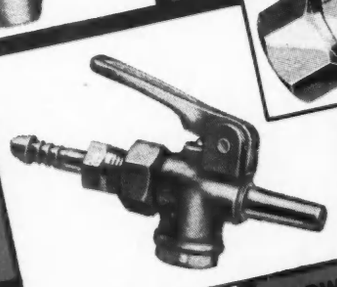
PIPE & HOSE UNION

GASOLINE COUPLING

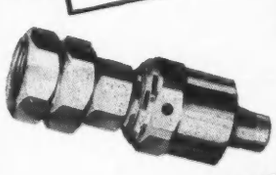


PUSH-TITE COUPLING

ACETYLENE COUPLING



BLOW GUN



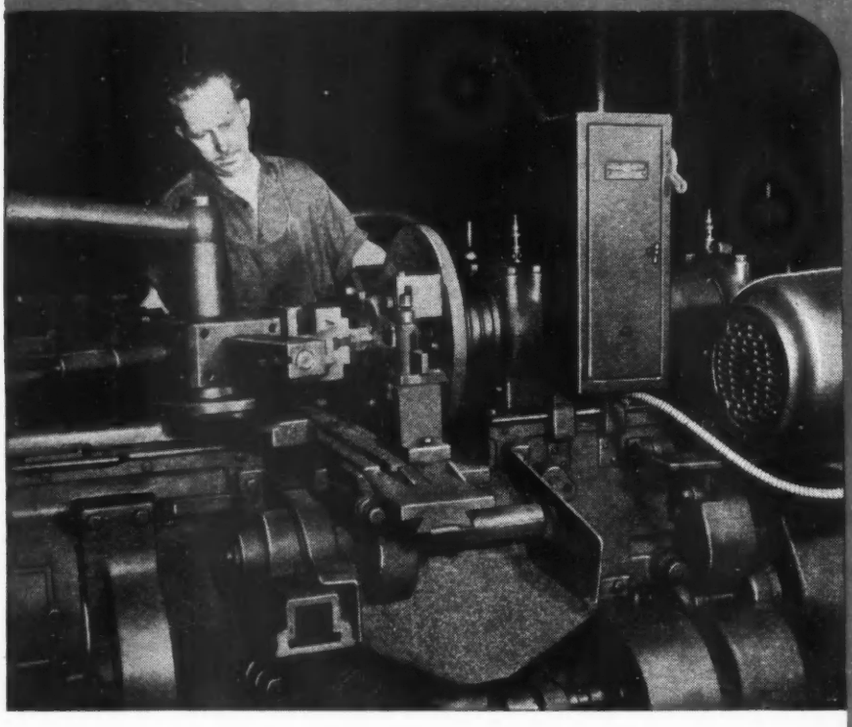
SWIVEL NUT HOSE CLAMP

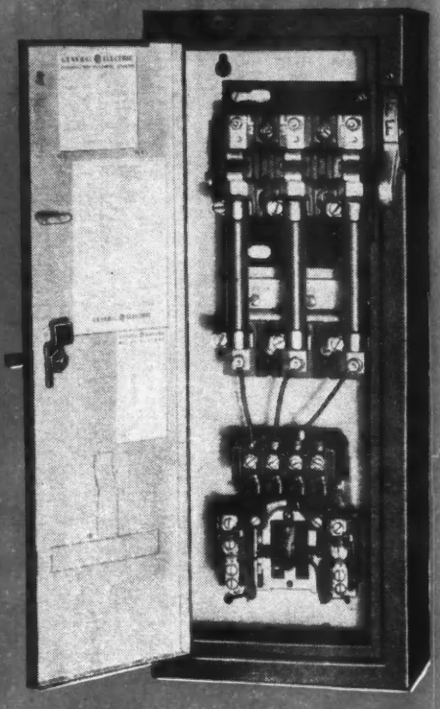
HANSEN MFG. CO.

1786 EAST 27TH STREET

CLEVELAND 14, OHIO

300 G-E COMBINATION MOTOR STARTERS...





...give White Motor Company real protection...save time, money, too.

Magnetic starter and motor-circuit switch in *one* unit—G-E "combination" motor starters of this type give co-ordinated control to over 300 machines in the White Motor Company plant in Cleveland.

The starter shown above is installed on a lathe used in making water pumps. Others control drill presses, shapers, boring mills, grinders, and many other types of machines.

Here's Why the Combination Starter Was Chosen

- Fast-acting overload relays protect the motor controlled from overheating—and fuses protect it from damaging short circuits.
- Safety for operators is assured by interlocking doors. While the power is on, the door cannot be opened.
- Quick servicing and availability of repair parts is made possible by G.E.'s broad network of sales outlets.

Wide Field of Application

This motor company represents just one of the many different industries in which G-E combination starters are at work today. Why not give the advantages of these compact, time-saving starters to *your* plant. Our engineers will be glad to help with your application. Get in touch with our local office today. ***Apparatus Dept., General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

676-200-8910

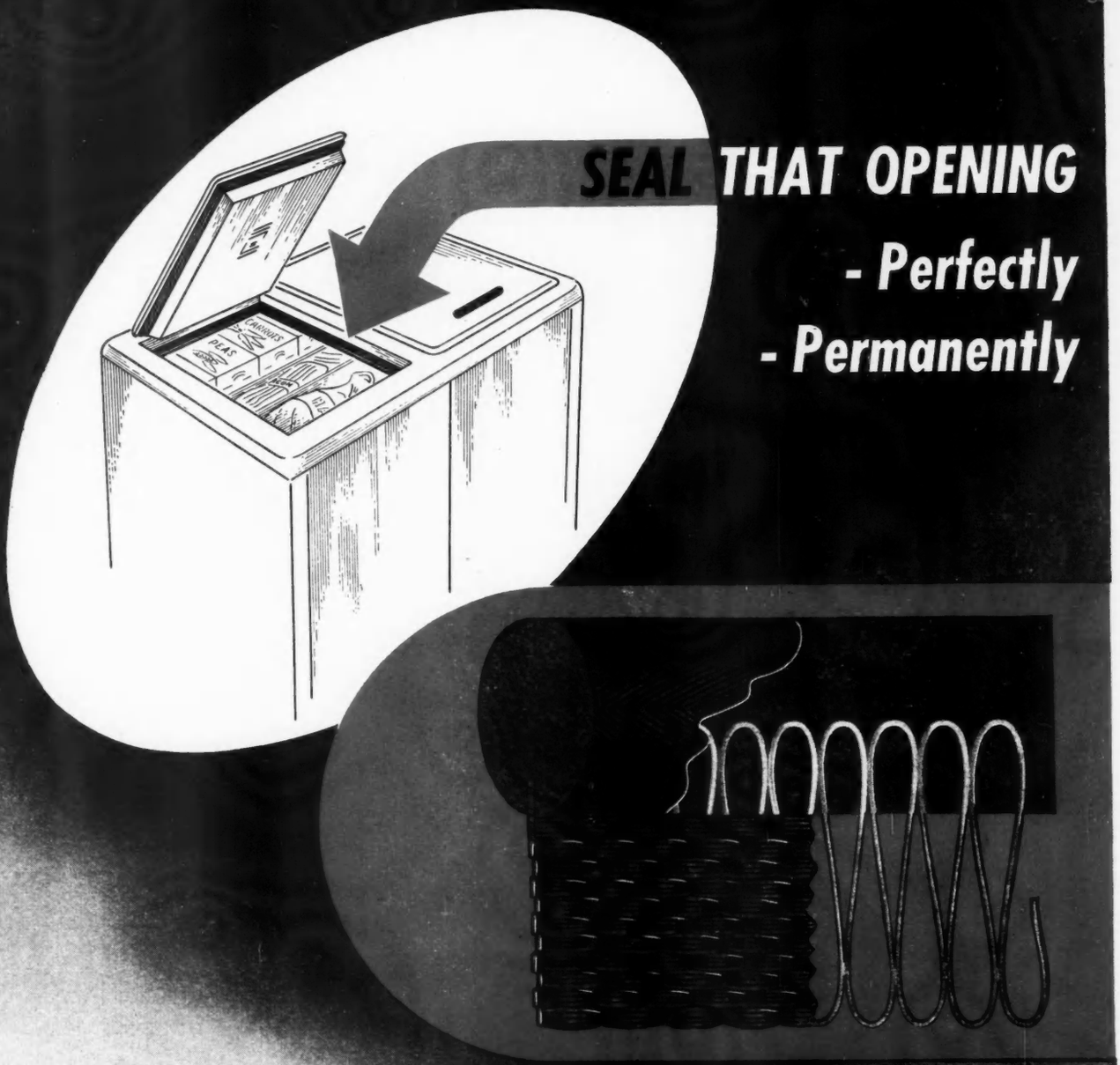
HOW YOU SAVE...

. . . TIME. Instead of buying two devices, you order and install only one. Mounting time is cut as much as 40 per cent.

. . . SPACE. Compact combination starters can be mounted in small unused places near to or remote from the operator.

. . . MONEY. The list price is slightly more than for two separate devices, but the difference is more than made up by savings in wire, conduit, and fittings.

MORE INFORMATION about combination starters is given in our Bulletin GEA-3715A. Ask our local office for your copy.



Here's the ONE weather stripping that won't flatten out in use — and the secret is simple: The rustless spring wire is bedded in resilient sponge rubber. It's totally unlike any other weather stripping you may have used in the past. It's available in a wide variety of sizes and colors for every weather proofing need. Send for a sample and you'll see what we mean. No obligation, of course.

Inner seal
WEATHER STRIPPING

BRIDGEPORT FABRICS, INC.

Established 1837

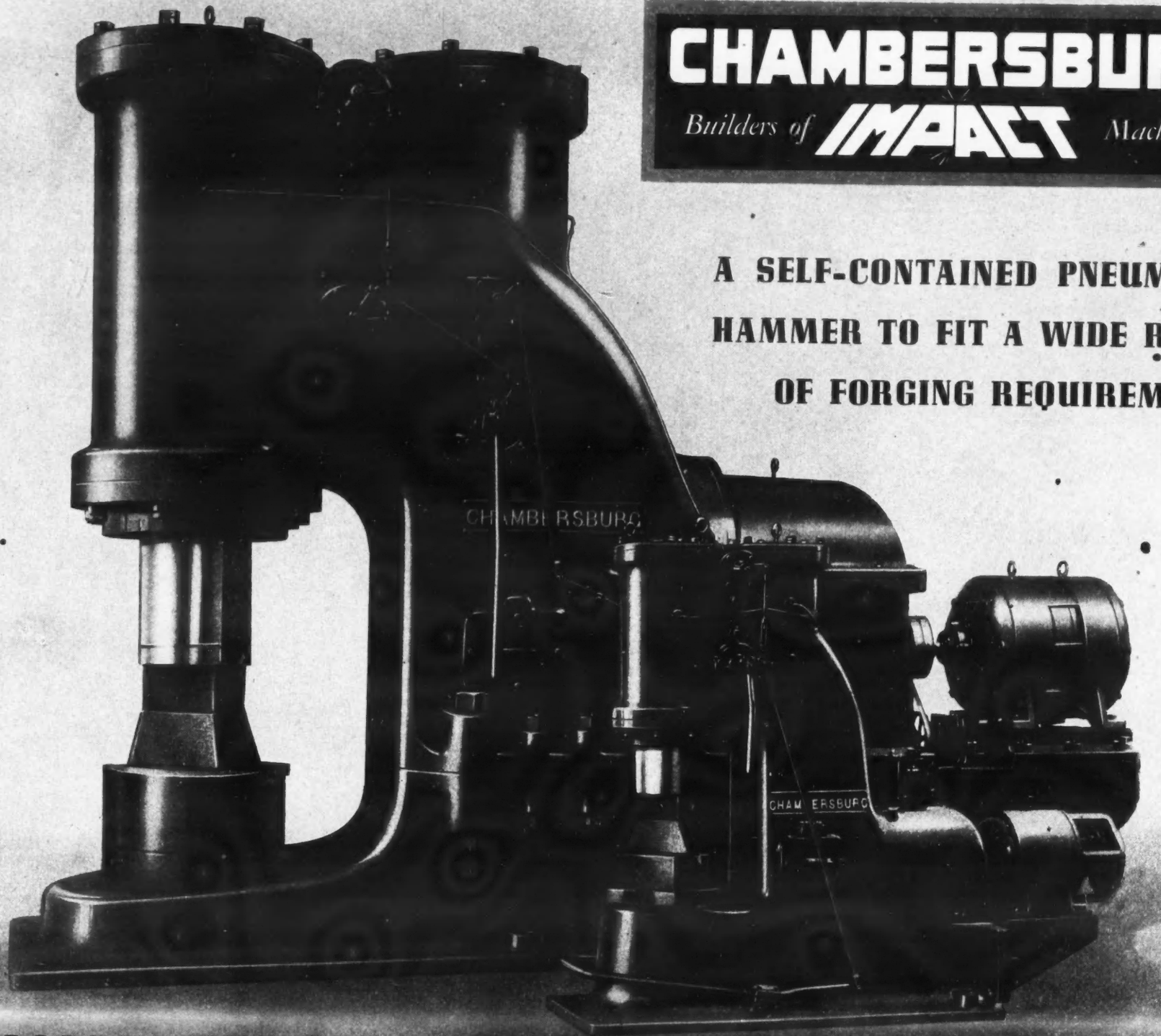
BRIDGEPORT 1 CONNECTICUT

CHAMBERSBURG

Builders of **IMPACT** *Machinery*

A SELF-CONTAINED PNEUMATIC HAMMER TO FIT A WIDE RANGE OF FORGING REQUIREMENTS

IN SIZES FROM 200 LBS. TO 5000 LBS.



CHAMBERSBURG ENGINEERING COMPANY, CHAMBERSBURG, PA.

CHAMBERSBURG ENGINEERING COMPANY, CHAMBERSBURG, PA.

Amphenol Components

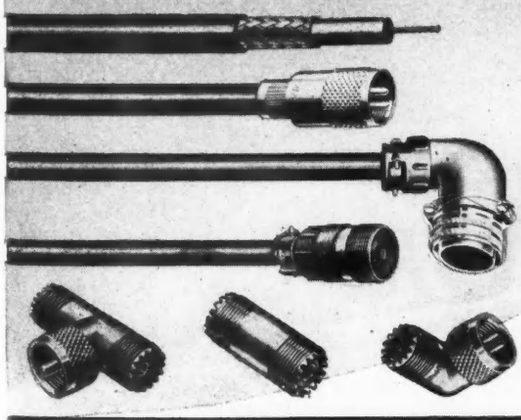
in Airborne Communications

AMPHENOL

● Airborne communications require the utmost efficiency in component parts in order to insure uninterrupted contact between the plane and ground stations. Playing an important part in maintaining this vital communication link are the inter-equipment cables, connectors and plugs.

An especially valuable asset of Amphenol connectors is the positive contact, quick disconnect feature. This enables maintenance men to substitute an operable communications or radar unit for a faulty one in a matter of a very few minutes. Repairs in the equipment can then be made on the ground while the plane continues on its scheduled flight.

Amphenol components are mechanically efficient and electrically correct. Electronic engineers, and radio and radar operators alike have, through long experience, come to place every confidence in the dependability and superior qualities of electronic components bearing the Amphenol name.

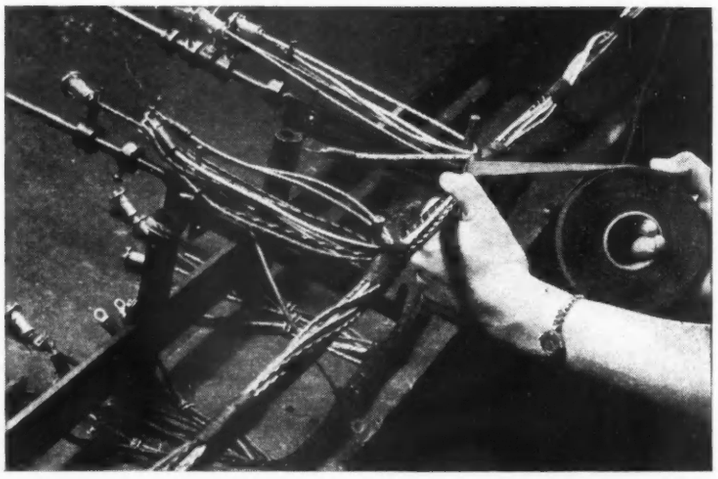


AMERICAN PHENOLIC CORPORATION
CHICAGO 50, ILLINOIS
In Canada
Amphenol Limited • Toronto

COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

Why you'll save three ways

by contacting Essex Specialists on "Packaged" Wiring Harness



Assembly layout

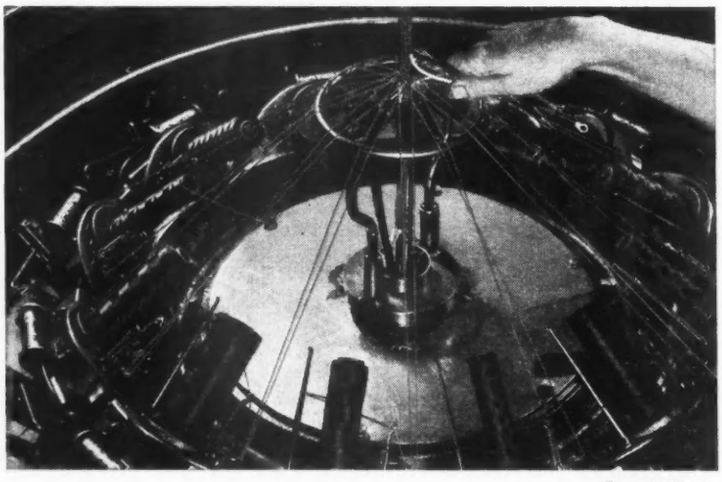
1

First Cost

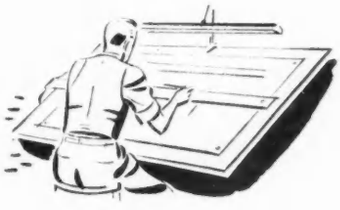
2

Installation

3



Braiding



Engineering

Through intensive specialization, Essex has developed economical line production methods of manufacturing, assembling and inspecting high grade wiring harness assemblies, custom engineered for your job.

You'll save *time, trouble and money* by calling on Essex *One-Source* service. For Essex will handle all details from engineering to delivery of the harness, *complete* with all manual and electrical control devices in a "packaged" unit . . . ready for quick, efficient installation.

Investigate Essex One-Source Service Today!

ESSEX WIRE CORPORATION FORT WAYNE 6, INDIANA

Plants: Fort Wayne, Indiana; Detroit, Michigan; Anaheim, California.
Warehouses* and Sales Offices: *Atlanta, Georgia; *Boston, Mass.; *Chicago, Illinois; Cleveland, Ohio; Dayton, Ohio; *Detroit, Michigan; Kansas City, Missouri; Milwaukee, Wisconsin; *Minneapolis, Minnesota; *Newark, New Jersey; Philadelphia, Pennsylvania; *St. Louis, Missouri; San Francisco, California; *Los Angeles, California.

WIRE SX PRODUCTS

AN EYE OPENER FOR THE INDUSTRIAL WORLD

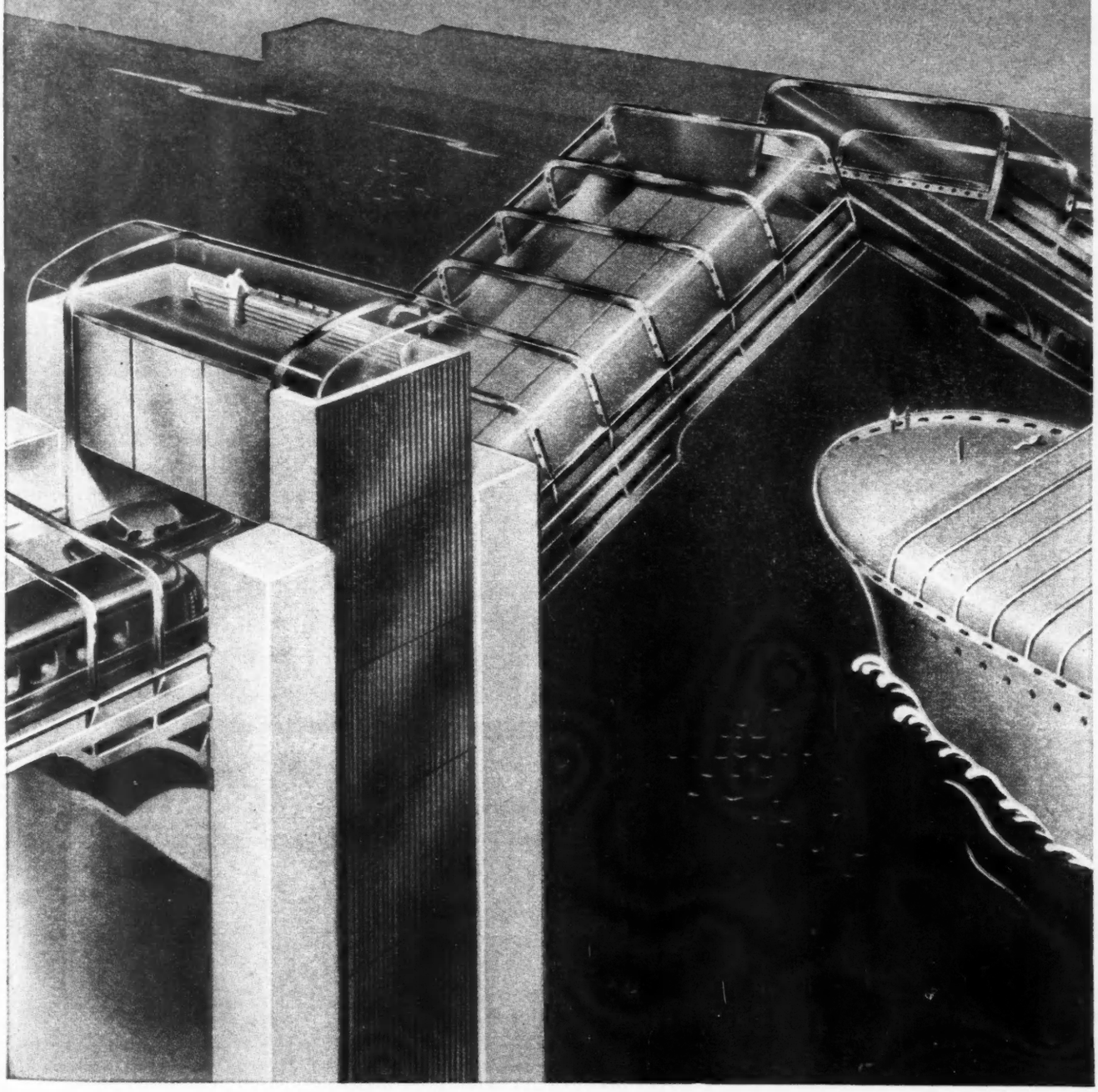
Covered bridges are reminiscent of days gone by. But here's one, made of aluminum and covered with plastic, that is a possibility for the world of the future. Bohn aluminum could readily figure in its construction, because aluminum combines those two sought-after qualities—strength with lightness. If this combination could be valuable in the products you make—our engineering staff would like to discuss with you the merits of aluminum or magnesium and possible applications.

BOHN

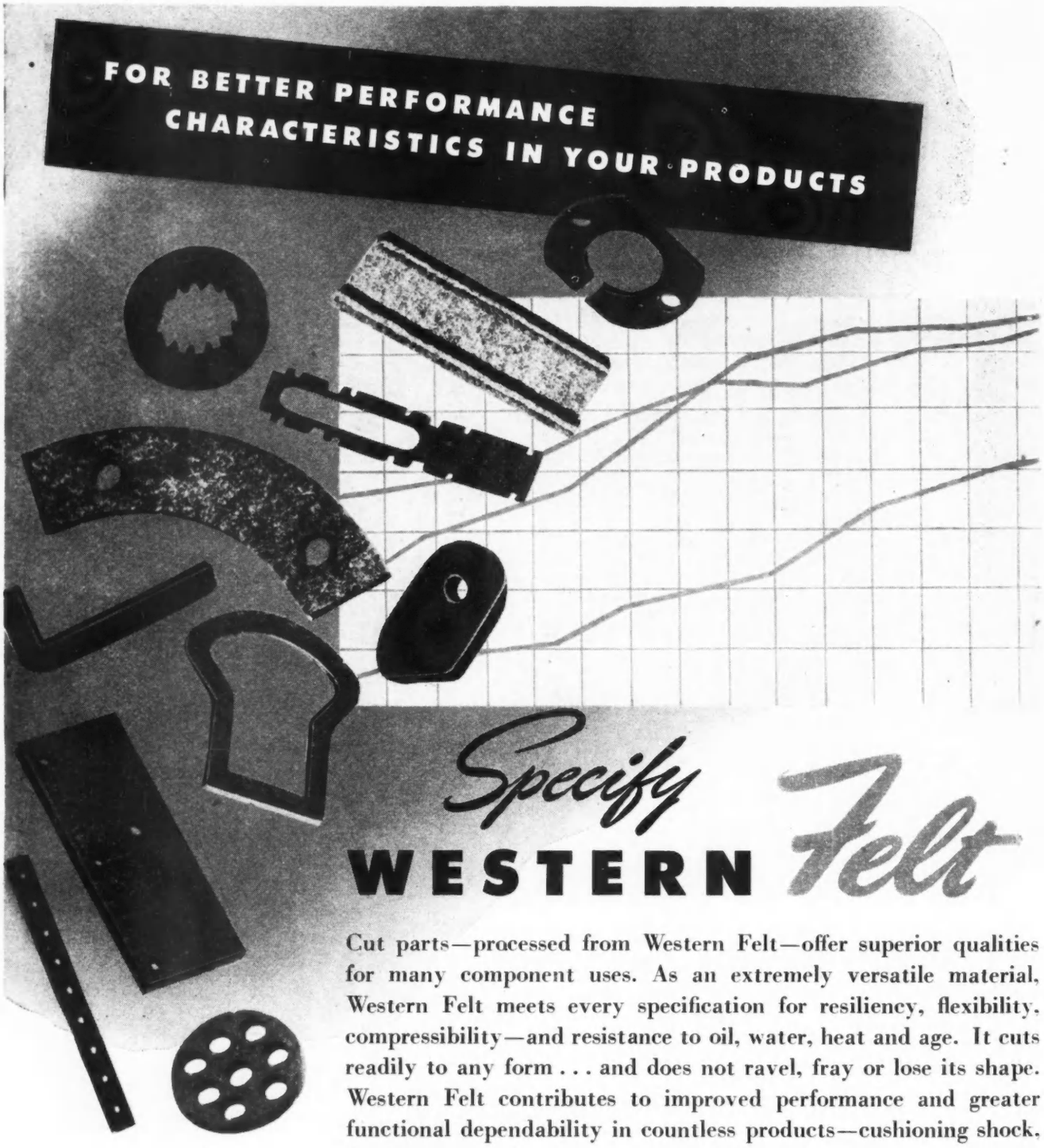
BOHN ALUMINUM AND BRASS CORPORATION • DETROIT 26, MICHIGAN

GENERAL OFFICES—LAFAYETTE BUILDING

Designers and Fabricators—ALUMINUM • MAGNESIUM • BRASS • AIRCRAFT-TYPE BEARINGS



FOR BETTER PERFORMANCE CHARACTERISTICS IN YOUR PRODUCTS



Specify WESTERN Felt

Cut parts—processed from Western Felt—offer superior qualities for many component uses. As an extremely versatile material, Western Felt meets every specification for resiliency, flexibility, compressibility—and resistance to oil, water, heat and age. It cuts readily to any form . . . and does not ravel, fray or lose its shape. Western Felt contributes to improved performance and greater functional dependability in countless products—cushioning shock, deadening sound, reducing weight, killing vibration, etc. *New uses are found daily.*

Let a Western Felt Works engineer check felt's potential application to your products. Write today.

Acadia Synthetic Products Division, WESTERN FELT WORKS, Processors of Synthetic Rubbers —Sheets, Extrusions, Molded Parts.

WESTERN Felt WORKS

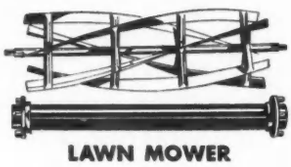
4035-4117 Ogden Avenue, Chicago 23, Illinois

Branches in All Principal Cities

Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felts

Spot the DIE CASTINGS

in this picture . . .



LAWN MOWER

AUTOMOBILE

HOSE

BICYCLE

DOOR KNOCKER

This domestic scene shows many of the streamlined labor and time saving devices upon which the modern homemaker depends. Their practical use, whether for recreation, home, garden or automobile, is frequently made possible through the use of quality zinc die castings.

Most manufacturers of these products choose many of their parts to be made of zinc die castings. At the left are illustrated some of the zinc die cast parts used in lawn mowers, hose connections, automobiles, bicycles and in the home. Their use has been decided upon because zinc die castings reduce production costs through the elimination of many hours of machining before finishing and assembling.

Perhaps you have production problems that can best be solved through the use of quality zinc die castings. If so, our Planning Department is available to discuss them with you.

CONTINENTAL DIE CASTING CORPORATION

Subsidiary of F. L. Jacobs Co.

9615 Grinnell Ave., Detroit 13, Mich. Plant No. 2, Holly, Mich.

FOR A FABRIC THAT DELIVERS THE GOODS—DEMAND

REEVES ARMY TWILL

"FROM COTTON TO CUTTER"

Look For This Label in Your Uniforms and Work Clothes!

Whatever your industry, it is good business to specify uniforms and work clothes of durable, smart looking Reeves Army Twill. Its high tensile strength insures rugged wearability. It tailors smartly, too, and is color-fast to sun, water and perspiration. Sanforized Shrunk*, it is the fabric for long-lasting economy. Remember—over 90 million yards of this same fabric helped equip America's fighting men—exceeding Government specifications under the toughest climatic and combat conditions.

*Residual shrinkage less than 1%

THE REEVES FABRIC GROUP INCLUDES: *Reeves Army Twill • Glengarrie Poplin • Reeveking Gabardine • Byrd Cloth • Marine Herringbone • Mountain Cloth • Warrior Twill*

SPINNING WEAVING DYEING FINISHING Reeves FABRIC

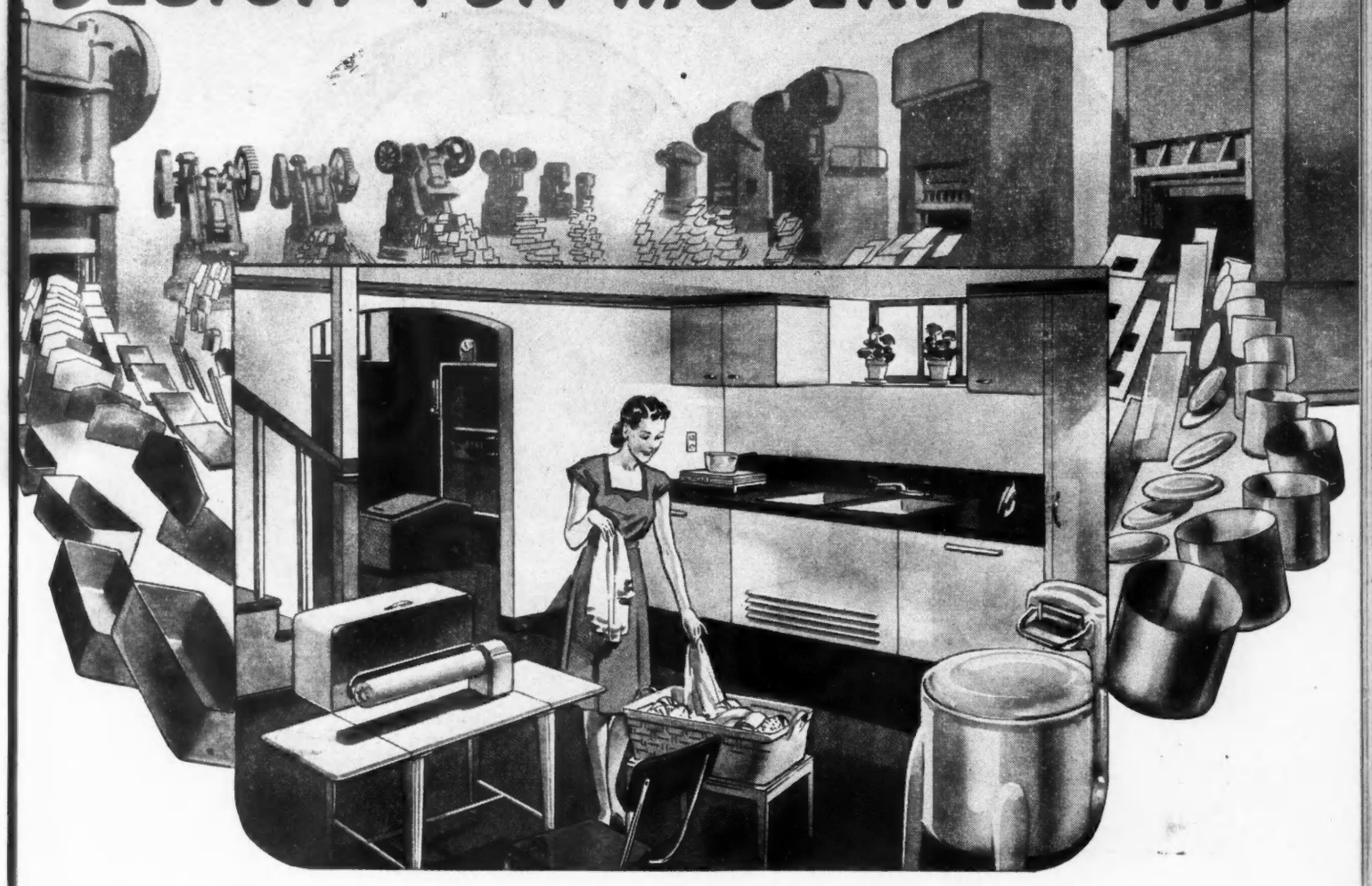
Mills Mill, Greenville, S.C. and Woodruff, S.C.
Fairforest Finishing Co., Spartanburg, S.C.

REEVES BROTHERS, INC.

54 WORTH STREET • NEW YORK 13, N. Y.

Representatives in Atlanta • Boston • Chicago • Dallas • Los Angeles • Philadelphia • St. Louis • Montreal • Toronto

DESIGN FOR MODERN LIVING



in Press Production Today

Designed for press production, the stamped products reaching the American Home—the new washing machine, electric ironer, stoker and metal cabinets—create a new design for living. The once messy basement becomes a modern, pleasant workroom.

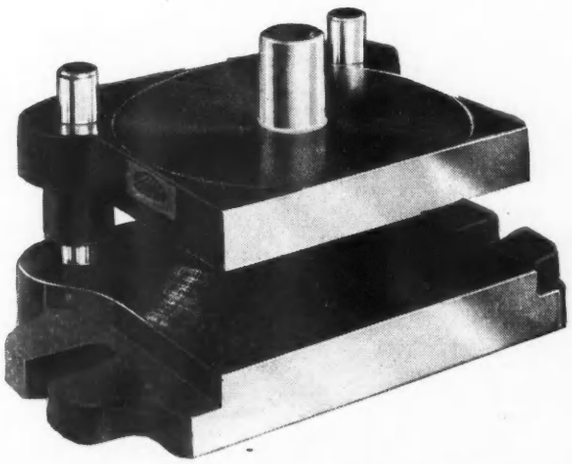
Wherever stamped products are being turned out, Danly Die Sets and Die Makers' Supplies guarantee precision, speed die making programs and cut "down time," because Danly means *known dependable accuracy.*

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue • Chicago 50, Illinois

DANLY *National Assembly*

Call Danly

- **MILWAUKEE 2** — *111 East Wisconsin*
- **DETROIT 16** — *1549 Temple Avenue*
- **CLEVELAND 14** — *1550 East 33rd Street*
- **DAYTON 2** — *990 East Monument*
- **ROCHESTER 4** — *16 Commercial Street*
- **PHILADELPHIA 40** — *3858 Pulaski Avenue*
- **LONG ISLAND CITY 1** — *47-28 37th Street*
- **DUCOMMUN METALS & SUPPLY CO.** — *4890 South Alameda, Los Angeles*



DIE MAKERS' SUPPLIES

DANLY DIE SETS

Welded Steel Fabrication

NOW! GAGE LIFE 12½ TIMES LONGER

...SERVICE RECORDS SHOW

5-PLUS FEATURES

1. Greater accuracy and stability
2. Longer wear life
3. Less weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

WOODWORTH THREAD RING GAGE PROVES AMAZING SUPREMACY OVER ORDINARY GAGES

Almost unbelievable results on actual shop inspection prove the new Woodworth Adjustable Thread Ring Gage far superior to ring gages of ordinary design.

ONE MANUFACTURER, USER OF MANY GAGES, MAINTAINED ACCURATE INSPECTION WITH A SINGLE WOODWORTH GAGE TWELVE AND ONE-HALF TIMES LONGER THAN WITH ANY RING GAGE PREVIOUSLY USED. THINK WHAT THIS MEANS TO YOUR GAGE COSTS.

Wire or write for folder No. 46R.

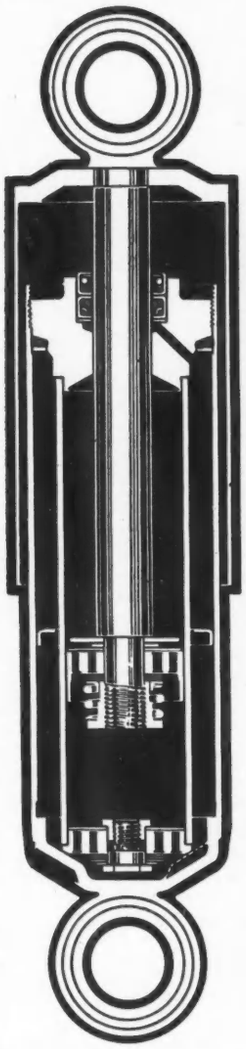
WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINE PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS

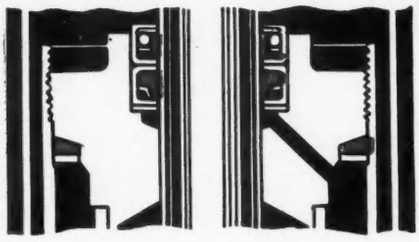
Double-Action Shock Absorber Uses Seals and Mounting Grommets of

TOUGH, DURABLE NEOPRENE

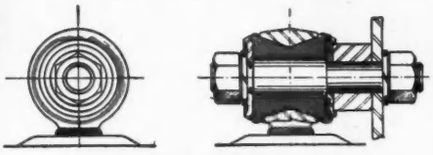


NEOPRENE SEALS

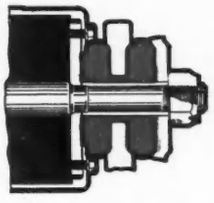
Prevent leakage of hydraulic fluid between piston rod and rod guide under light pressure or leakage from reserve tube through rod guide threads. Not affected by the fluid. High resistance to wear from constant, heavy friction due to angle mounting on vehicles.



NEOPRENE GROMMETS



Loop type bushing, **compressed at assembly, allows deflections either way—20° radial and 5° axial.**



Stem end type bushing, **compressed at assembly, allows up to 10° angular movement in any direction.**

Illustrations courtesy Monroe Auto Equipment Co.

THIS SHOCK ABSORBER is standard on many automobiles, trucks and railway cars (passenger and freight). During the war it was standard on light and medium combat tanks—within both horizontal volute spring and "torsion bar" suspension systems.

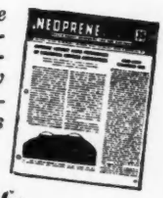
Neoprene was chosen for this application because it gives long life and trouble-free operation—resisting deterioration from hydraulic fluids, wear from friction and permanent set from static loads.

Look to neoprene for your own success in designing—*wherever* problems of resilience, elasticity and tensile strength are involved. Depend on neoprene for outstanding performance and economy.

Here's Why Neoprene DOES SO MANY JOBS SO WELL!

- ★ High tensile strength, resilience, low permanent distortion.
- ★ Tough and durable, resists abrasion and cutting.
- ★ Superior resistance to sunlight, aging, ozone, and heat.
- ★ Resistance to deterioration by oils, solvents, chemicals, acids.
- ★ Superior air-retention, low permeability to gases and fluids.
- ★ Special compositions are flame-retarding, static-conducting, flexible at low temperatures.

Write for *your free subscription to The Neoprene Notebook. Packed with information about new or unusual neoprene applications—which may give you valuable new ideas. Back issues on request. Rubber Chemicals Division E-6, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.*



For Better Equipment, Specify

DU PONT NEOPRENE

The VERSATILE Synthetic Rubber

BETTER THINGS FOR BETTER LIVING
. . . *THROUGH CHEMISTRY*

DU PONT
REG. U. S. PAT. OFF.

Specify Fuller

FOR YOUR *Balanced* TRUCK

In heavy-duty hauling the trend is to "balanced trucks." Most fleet owners specify their own "balance" . . . the combination of chassis, engine, transmission and other assemblies which does their particular job best—at lowest cost. Because of the efficient performance, quiet running and long wear-life of Fuller Transmissions, more and more leading operators are specifying Fuller for their "balanced trucks." Why not take a tip from these profit-wise operators who say: "Specify Fuller. It pays!"

Fuller TRANSMISSIONS

FULLER MANUFACTURING COMPANY, TRANSMISSION DIVISION
KALAMAZOO, 13F, MICHIGAN
Unit Drop Forge Division, Milwaukee 1, Wisconsin

SHAKE THE "WOBBLE-WORRIES"

. . . with Corbin-Phillips Screws!

Drive an ordinary screw and you'll get the "Wobble Worries" . . . fear that the driver will slip from the slot and jimmy up the product. Wobble Worries slow you down!

Wobble Worry accidents are wasteful and costly. They have no place in a competitive economy. Eliminate them once and for all with the "Centered Driving" of Corbin-Phillips Screws.

With Corbin-Phillips, the bit is anchored in the screw both ways — and the screw is driven true all the way. Spoiled work stops — production goes up — and Wobble Worries go out the window.

And remember, Corbin-Phillips Screws are noted for their *uniformity*.

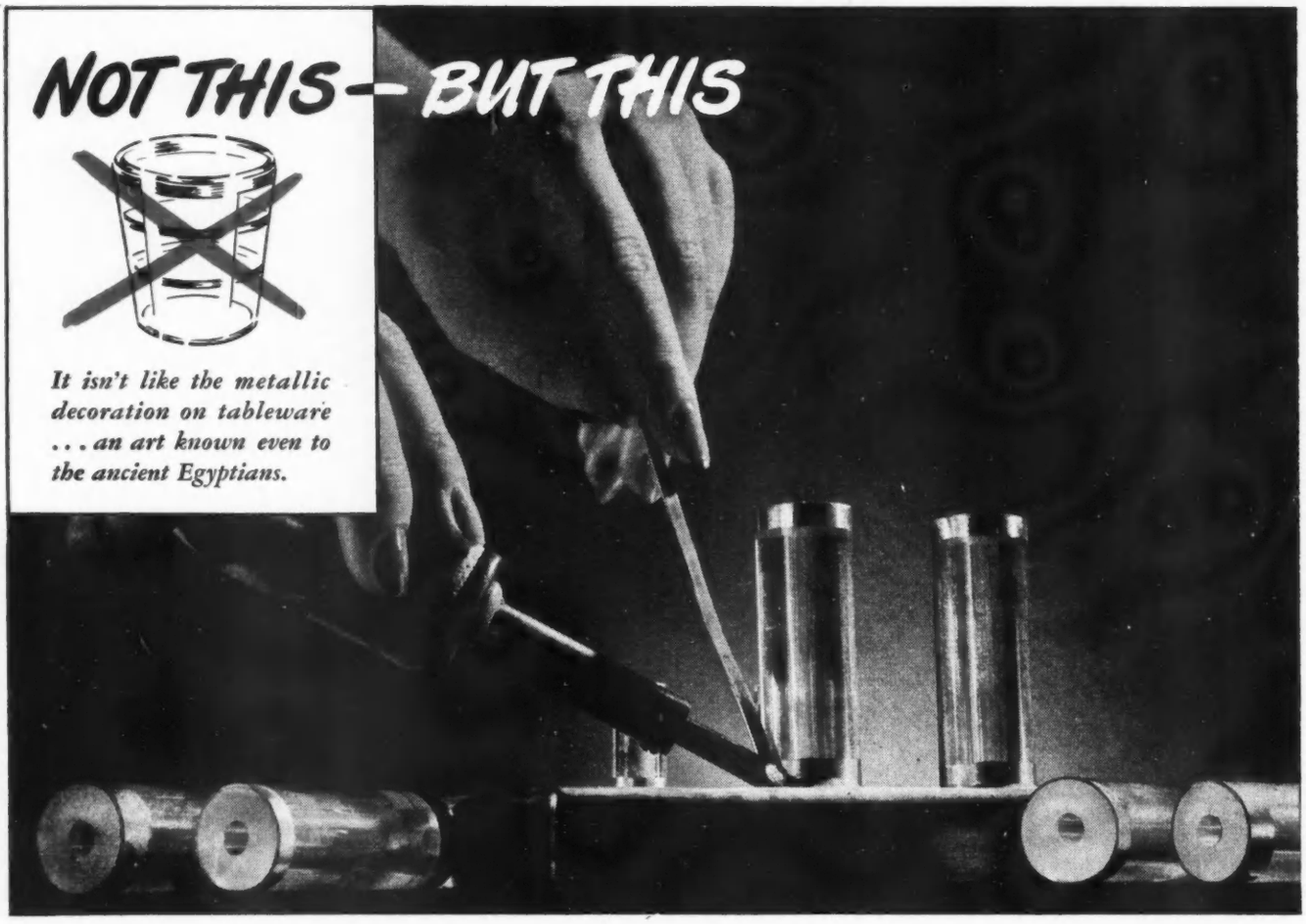
CORBIN SCREW DIVISION
The American Hardware Corporation
NEW BRITAIN • CONNECTICUT
Warehouses:
New Britain • New York • Chicago

CORBIN PHILLIPS Screws

WHAT IS CORNING METALLIZING?

NOT THIS — BUT THIS

It isn't like the metallic decoration on tableware . . . an art known even to the ancient Egyptians.



CORNING metallizing is a permanent union of metal to glass so strong it will withstand a pull of 2000 pounds per square inch! This kind of metallizing permits a glass part to be permanently soldered into place. And that means fewer parts, faster assemblies, hermetic seals, better products!

When you think of Corning metallizing, forget about metal that's just painted on—or cemented on—or cast on. This is something entirely different, a development of Corning Research, which is doing a real job in a dozen different industries. Corning metallized glass parts are available in virtually any shape or size or glass formula. To get the complete story, write today for bulletin EL-Z-Z10. Or if you have an immediate problem you think Corning metallizing might solve, one of our engineers will call at your convenience. Electronics Sales Department V-6, Technical Products Division, Corning Glass Works, Corning, N. Y.

HOW MUCH DOES IT COST?

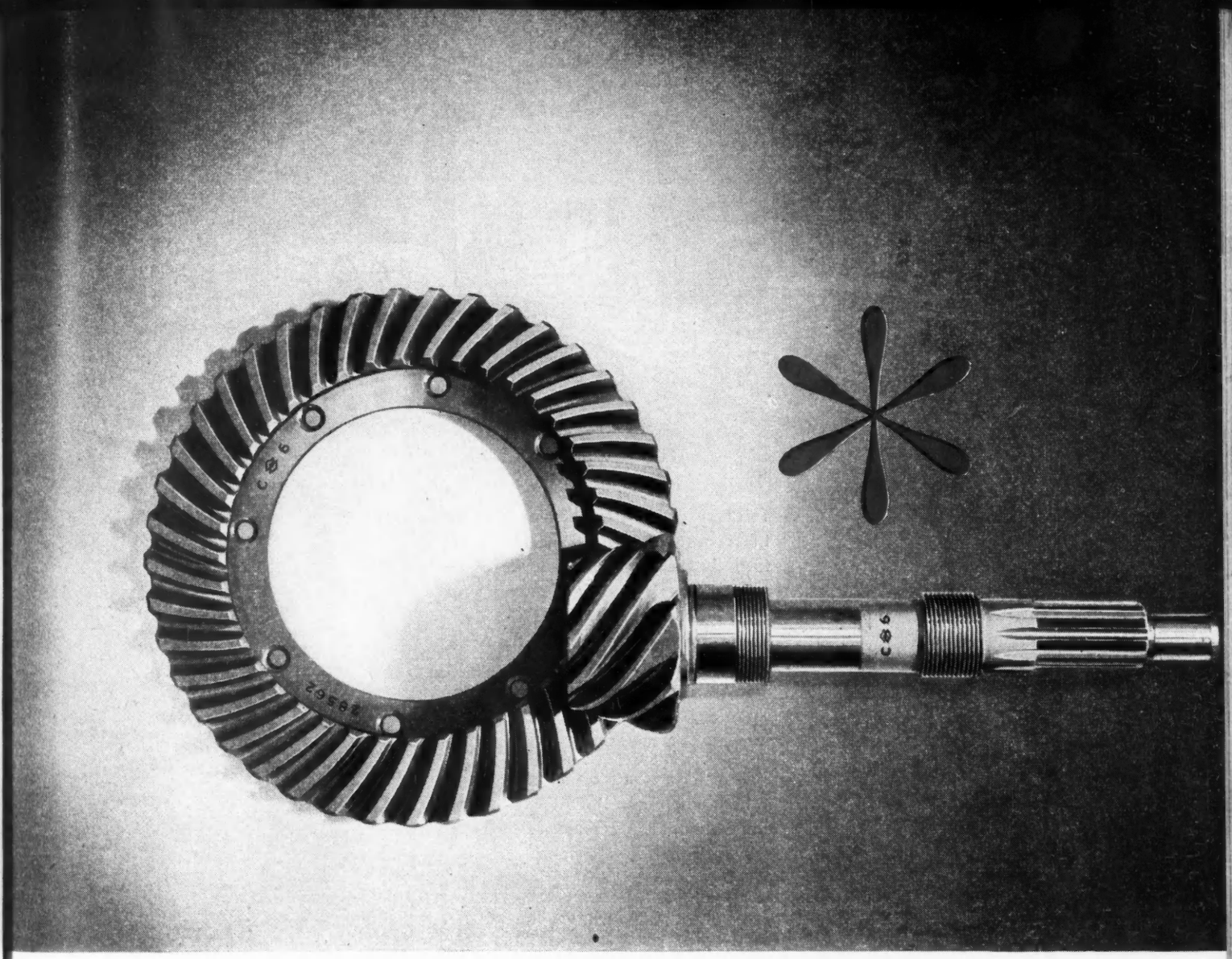
Without knowing exactly what you want, that's hard to say. But this glass tube ½" in diameter by 1½" long with ¼" metallized bands on each end, in lots of 100,000 to 1,000,000, costs from 2c to 5c each, depending on the glass and tolerances required.

CORNING *means* Research in Glass

Electronic Glassware

VYCOR REG. U.S. PAT. OFF. — CORNING REG. U.S. PAT. OFF. — PYREX REG. U.S. PAT. OFF.

"PYREX", "VYCOR" *and* "CORNING" *are registered trade-marks and indicate manufacture by Corning Glass Works, Corning, N. Y.*



Plan to Gear-up for Silence

CHECK DESIGN... practical high-efficiency gear design requires the kind of specialized engineering skill and experience that assures silent, effective transmission of power on a long-time basis. Double Diamond Engineers are ready to help you plan and design your gear, gear-shaft and power transmission equipment. Use this consultation service any time.

CHECK PRODUCTION...it's one thing to custom build top quality into just a few gear sets...but it's another matter to maintain precision standards in quantity production. Specify Double Diamond and you are assured of precision gears on a production basis *comparable in long-lasting smoothness of action to the jewel movement in finest instruments.*

CHECK PRODUCT...design and production mean nothing *unless* you can be sure the finished gears provide smooth long life and trouble-free service.

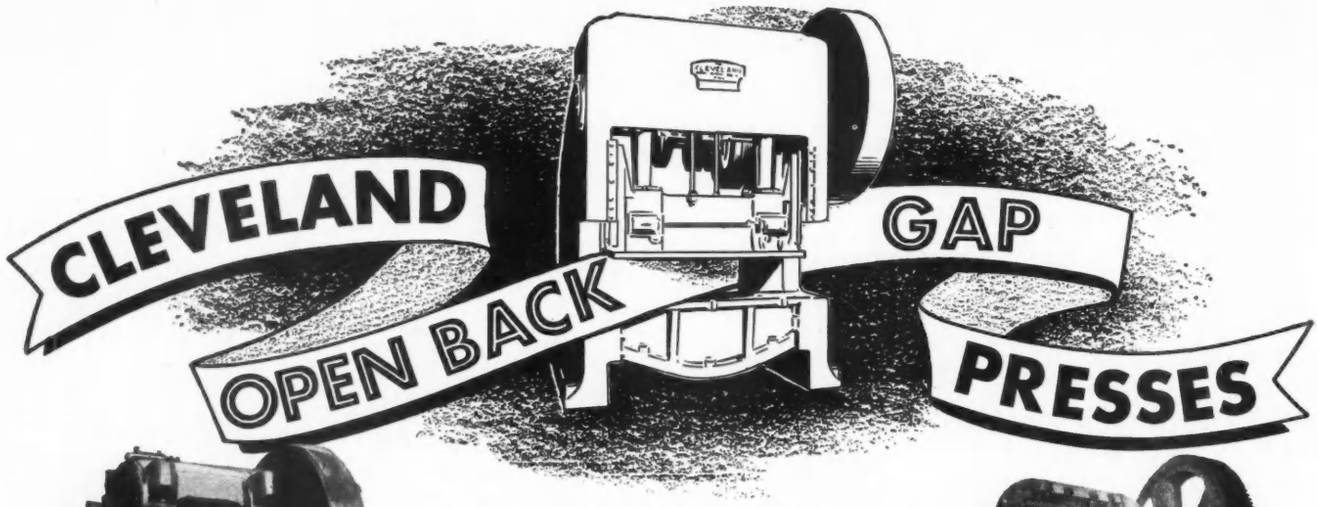
Double Diamond Gears with the famous "jewel movement" are your assurance of quick, correct assembly and long-term satisfaction in the finished product.

AUTOMOTIVE GEAR WORKS, INC., RICHMOND, INDIANA

DOUBLE DIAMOND TRADE MARK GEARS

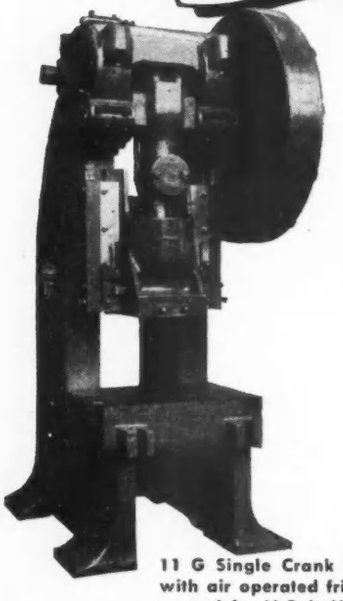
*the gears with the "JEWEL MOVEMENT"**

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS

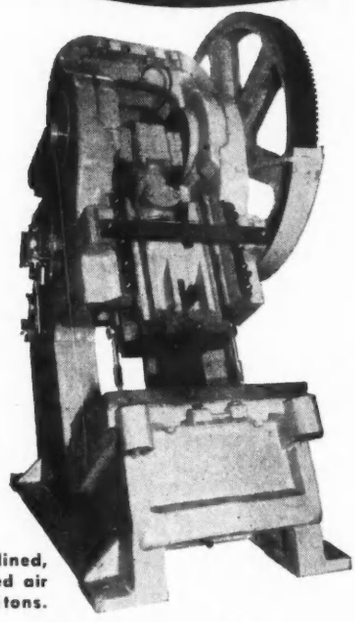


This type of Press is recommended for the convenience which the frame affords in the handling of large or irregular sheets and for feeding strip stock right and left across the dies. They are used extensively in the Automotive, Electrical, Agricultural and many other industries for punching, shearing, perforating, bending and forming operations.

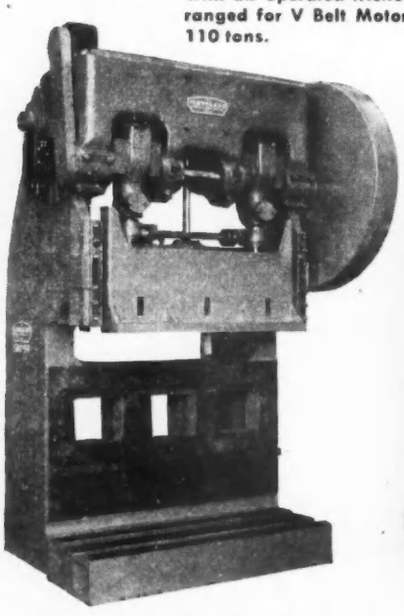
Built in wide range of standard sizes in both Single and Double Crank they can be modified in many respects to suit particular requirements.



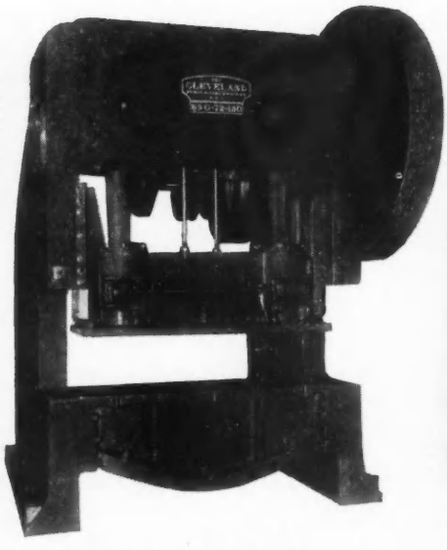
11 G Single Crank Gap Press equipped with air operated friction clutch, and arranged for V Belt Motor Drive. Capacity 110 tons.



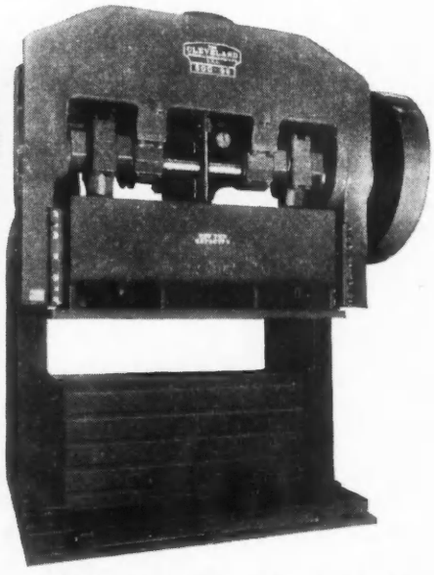
15 G Single Crank Gap Press, inclined, equipped with electrically controlled air operated friction clutch. Capacity 215 tons.



50-G-54 Double Crank Gap Press, flush front, equipped with air operated friction clutch, air counterbalance, air brake on flywheel. Capacity 90 tons.



65-G-72 Double Crank Gap Press, equipped with electrically controlled air operated friction clutch. Capacity 150 tons.



80-G-96 Double Crank Gap Press, flush front, equipped with hydraulically operated friction clutch, air counterbalance. Capacity 255 tons.

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY

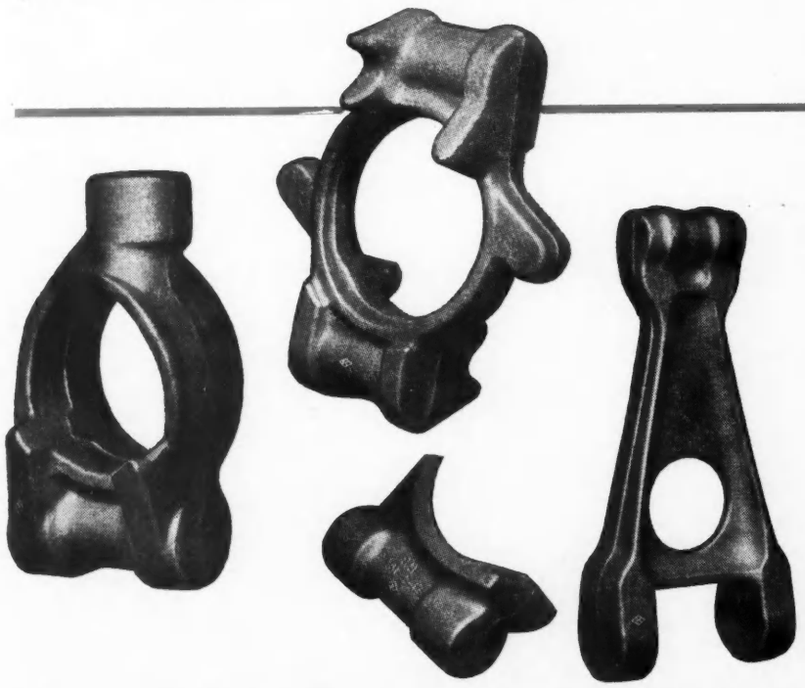
Cleveland 14, Ohio

Consider the use of Forgings FIRST for Your New Machines

Grain Flow—Forgings are made from stock that has been rolled, in which process is initiated the elongated grain structure of the metal, which gives forged parts their superior performance. In the forging process this fibrous structure is intensified and the grain flow advantageously directed with concentration (toughness) at points of greatest shock and strain.

Strength—Forgings provide metals at their ultimate strength and toughness. For centuries, forgings have been universally employed for parts subjected to tensional and torsional stresses. No later day method of producing metal parts has equalled forgings in this respect. As forgings are metal in an intensely compressed state, they are likewise highly resistant to compression and impact stresses.

Machineability—With the close tolerances obtainable in present forging practices, supplemented by modern methods of cleaning the parts after forming, forgings generally require less time to machine and finish, because there is less metal to remove. This results in reduced machining and tool costs. Additionally, as the direction of the grain flow is known, machining operations are facilitated.



Savings in Weight and Metal—In many modern machines, weight reduction is an important advantage. The forging process produces maximum strength, permitting the use of thinner metal sections, resulting in parts of less weight, with corresponding saving of metal. Valuable space may also be saved. With this weight saving applied to a number of parts, the weight of an entire machine may be substantially reduced.

Fatigue Resistance — The service life of machine and equipment parts, especially those subjected to repeated stresses in continuous service, is largely measured by their fatigue resistance. Forgings embody the highest obtainable fatigue resistance. Every step in the forging process, including modern heat treatment, adds something to the useful life of the part. Too, forging always enhances the safety factor.

Kropp Forge—the "world's largest job forging shop"—offers a complete engineering and production service on flat die, drop and upset forgings of steel or non-ferrous metals, including, where desired, heat treating and rough or finished machining.

Forgings can be delivered promptly—don't wait for parts of other materials. When you need flat die, drop or upset forgings, call the nearest Kropp engineering representative. He is shop-trained and can give you practical help on your forging requirements. If you prefer, send your blueprints direct for quotation.

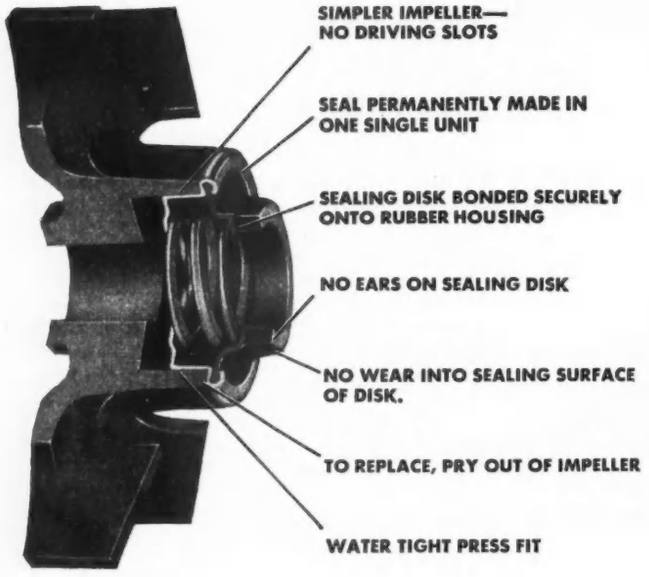
Engineering Representatives in Atlanta, Birmingham, Buffalo, Cedar Rapids, Cleveland, Dallas, Detroit, Houston, Indianapolis, Los Angeles, Milwaukee, New York, Portland, Rockford, St. Louis, St. Paul, San Francisco, Seattle, South Bend, Tulsa. Canada: Montreal, Toronto, Vancouver, Winnipeg.

KROPP FORGE COMPANY
5301 W. Roosevelt Road
Chicago 50, Illinois

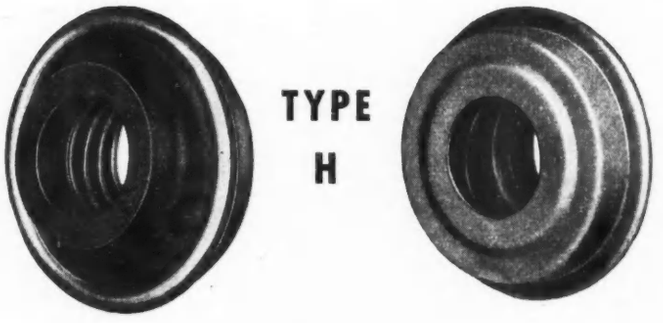
KROPP

FORGINGS TO YOUR SPECIFICATIONS

AQUA-TITE *A New and Advanced* AUTOMATIC SHAFT SEAL



Developed to meet the demands for a perfect automatic shaft seal for all purposes. It has a rare combination of advantages in that it is extremely simple, costs less, saves machining and installation costs, and will do a better job of sealing through a longer life like all Aqua-Tite seals.



OUTSTANDING FEATURES...

- ★ Comes as a single unit.
- ★ One piece only to handle.
- ★ One sealing surface only.
- ★ Consequently—less spring pressure—less wear.
- ★ No slots in pumps or impellers.
- ★ Fool proof—only one way to assemble.
- ★ Easy to install, easy to replace.

The sealing disc is made of a carbon alloy, a material recognized as superior for the purpose. It is securely bonded integrally to the rubber housing and thus eliminates the sealing disc as a separate piece and, consequently, one of the faces to seal. This reduces the usual functions of the spring to keeping only one set of surfaces in sealing contact. . . . The materials used in the Type H seal are the same so carefully selected and proven in millions of other Aqua-Tite seals. All metal parts are non-corrosive and the important spring is safely protected inside the seal.

Cutaway view of (left) Type H seal installed in an automobile water pump housing, (right) Type H seal itself

Note the utter simplicity of both pump housing and impeller—how core making and machining costs of pump are reduced.

(PATENT APPLIED FOR)

A COMPLETE WATER PUMP SERVICE—a fine seal—a fine impeller—or a complete pump for your new product or improving present models. Send us your inquiries. We have advantages in both performance and price.

Send today for Our New Book—"Automatic Shaft Seals"—a Schwitzer-Cummins Development

SCHWITZER-CUMMINS COMPANY

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KEMPSMITH ALL-GEARED DRIVE for POSITIVE POWER and SMOOTH MILLING

It's Chatter Free!

Precision Anti-friction Bearings Used for Spindle Mountings and All Gear Mountings . . .

57 Years of specialized Experience Building Milling Machines and Attachments Exclusively.

For sheer ruggedness and power, you just can't beat a KEMPSMITH Milling Machine. That's because it's engineered and built for the really tough jobs. For example, KEMPSMITH has combined all-geared transmission, precision anti-friction bearing mountings and automatic splash lubrication to attain maximum transmission of positive power . . . chatter-proof smoothness in cutting . . . and long life accuracy. 13 gears permit a selection of 18 speeds and 18 feeds . . . yet there are never more than three gear contacts between clutch and cutter. The large precision-built spindle gear is always in mesh when the machine is taking heavy loads. This assures smooth, chatter-free milling, even with large diameter cutters. Consider a new, rugged KEMPSMITH the next time you need milling equipment.

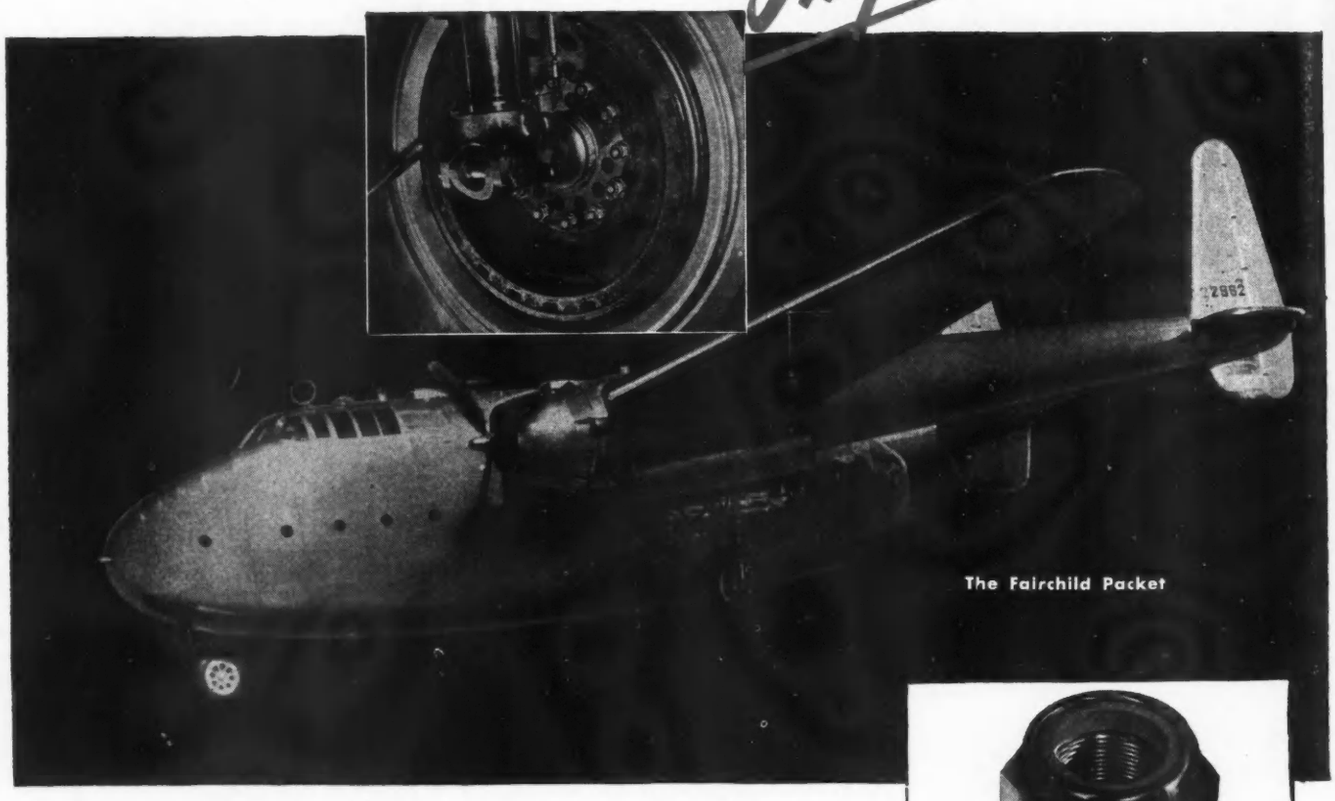
Write today for literature.

The KEMPSMITH MACHINE CO., Milwaukee 14, Wis., U.S.A.

Precision Built Milling Machines Since 1888

A 4979-1P-C

DAMPENING THE *Landing Impact* STRESSES

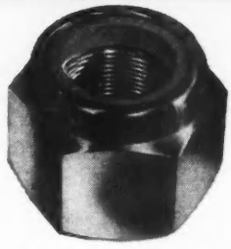


—with the Red Elastic Collar that protects permanently against Thread Failure

Thread damage—caused by landing impact stresses set up by the 45,000 pound Fairchild C-82 "flying boxcar" made every bolted connection on the tricycle landing gear a critically important fastener application. Prestressed settings had to be maintained against flight vibration. Full thread contact had to be provided to dampen the shock and prevent metal fatigue. Here again, ESNA Elastic Stop Nuts provided the permanent protection that has made them symbols of security to all aviation engineers. ESNA Elastic Stop Nuts are self-locking, easily removable, and reusable over and over. They protect permanently against Vibration, Corrosion, Thread Damage, Liquid Seepage and Costly Maintenance.

If fastening problems slow up your production or increase your maintenance costs, let us place the results of our experience and research at your disposal now.

Address: Elastic Stop Nut Corporation of America, Union, New Jersey. Representatives and Agents in many principal cities.



The RED ELASTIC COLLAR

— denoting an ESNA product —

. . . is threadless and permanently elastic. Every bolt — *regardless of commercial tolerances* — impresses (does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads — and eliminates all axial play between bolt and nut threads.

As a result, the Red Elastic Collar acts as a shock absorber. It dampens impact stresses — and materially reduces the shock against the metal threads that causes thread failure in conventional fasteners.

ELASTIC STOP NUTS

INTERNAL WRENCHING

ANCHOR

INSTRUMENT MOUNTING

SPLINE

CLINCH

GANG HANNEL

CAP

PRODUCTS OF: **ELASTIC STOP NUT CORPORATION OF AMERICA**

NEW AND IMPROVED DU PONT SOLVENT for VAPOR DEGREASING

AVAILABLE NATIONALLY THROUGH DISTRIBUTORS!

UNDER VARIOUS TRADE NAMES, Du Pont Trichlorethylene and Perchlorethylene solvents for metal cleaning have served American industry successfully for many years. If you have used vapor degreasing solvents in your plant, no doubt you have used these solvents made by Du Pont.

NOW Du Pont has developed *new and improved* Trichlorethylene and Perchlorethylene — the same fine solvents, but BETTER THAN EVER, thanks to various technical improvements. These are the best Vapor Degreasing solvents we've ever made—the best we know how to make. Use them with complete confidence and assurance for all metal degreasing work. We believe they'll serve you *better!*

NEXT TIME you specify solvents for Vapor Degreasing, specify *new and improved* Du Pont Trichlorethylene and Perchlorethylene—available nationally through distributors as "Triclene" D and "Perclene" and under other trade names. Look to these solvents for superior work, maximum savings! Send today for your copy of our new free book, "Metal Degreasing— Standard Practices."

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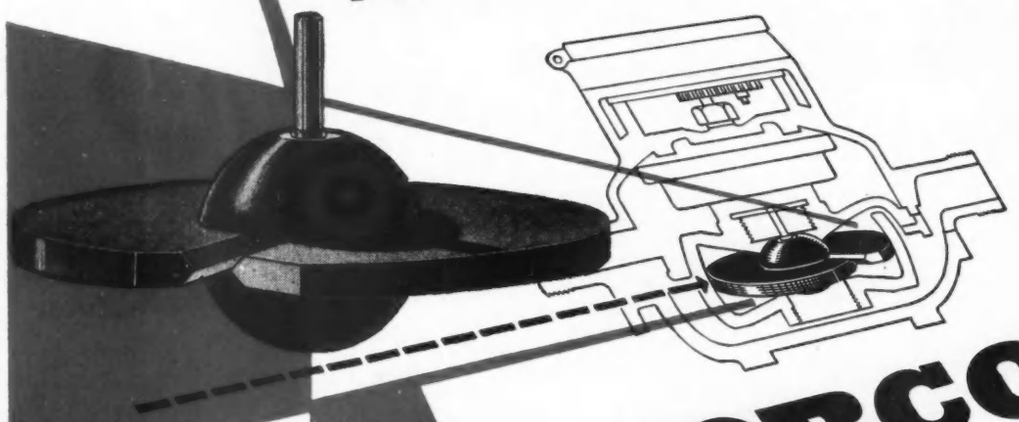
DU PONT SOLVENTS

FOR THOSE TOUGH PROBLEMS IN RUBBER



Above views illustrate a "NO-WARP" water meter disc and its position in a typical meter.

CALL "ORCO" FOR THE CORRECT SOLUTIONS!

This is a "sample" of "ORCO-OPERATION" . . . the kind of co-operation YOU can expect when YOU refer YOUR problems in rubber to ORCO.

More than ten million water meters are in use in this country. Many of them are of the "disc-type" similar to the sectional drawing above. Accuracy and sensitiveness of water meters are dependent upon the accuracy of component parts, especially the DISCS. Ordinary discs are subject to warping and distortion with resultant inaccuracies of meters. To eliminate such troubles, The Fred W. Hanks Company of Cleveland, Ohio, supply water system departments with NO-WARP Discs of all types used in the U. S. A. and Canada.

"Hanks NO-WARP discs" are made of a special material originated by Fred W. Hanks. Not only must this material be compounded to consistently uniform standards of toughness but it must conform to exacting standards of specific gravity and accurate machinability.

According to Mr. George A. Miller, Superintendent of The Fred W. Hanks Company, the required accuracy of compounding and molding NO-WARP Discs is the kind of ORCO-OPERATION his company is receiving from The Ohio Rubber Company. "It's a tough assignment for any rubber manufacturer," says Mr. Miller, "and we are certainly pleased with the way ORCO handles our work."

* * * * * * *

When YOU have a problem in rubber (hard or soft and of any type) call ORCO and let ORCO-OPERATION work for YOU.

THE OHIO RUBBER COMPANY

Orco-operation

WILLOUGHBY, OHIO

Factories: WILLOUGHBY, OHIO • LONG BEACH, CAL. • CONNEAUTVILLE, PA.

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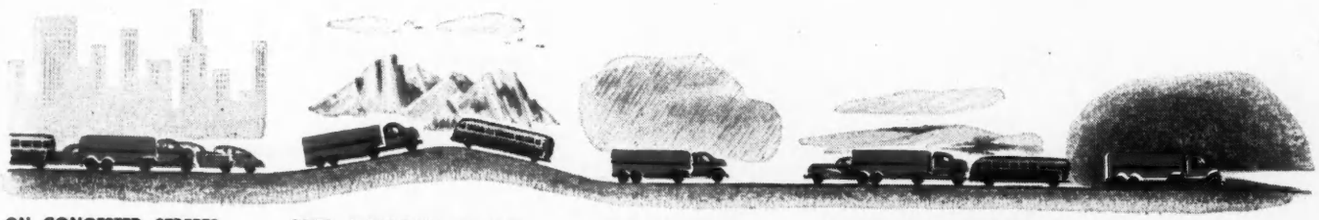
We didn't write this statement —

EXPERIENCE DID!



ON CONGESTED STREETS . . . OVER MOUNTAIN GRADES . . . THROUGH STORMS . . . ON CROWDED HIGHWAYS . . . DAY OR NIGHT . . .

the best brake is AIR!

BENDIX-WESTINGHOUSE GENUINE AIR BRAKES

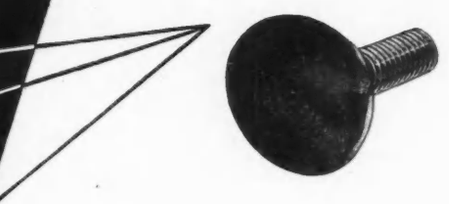
Millions of miles of experience under every conceivable condition stands behind the statement "The Best Brake is AIR"—a statement that every truck and bus operator knows to be a fact! And experienced operators also know that the finest Air Brakes bear the name Bendix-Westinghouse—the oldest, largest, and most progressive manufacturer in the field. Regardless of the type of equipment you operate or the terrain it encounters, Bendix-Westinghouse Air Brakes can add safety, driver satisfaction, and economy to your business. Let your Bendix-Westinghouse distributor show you how simple and inexpensive it is to modernize your present equipment with Air Brakes, or assist you in selecting, for new equipment, the right kind of Air Brakes for the specific job.

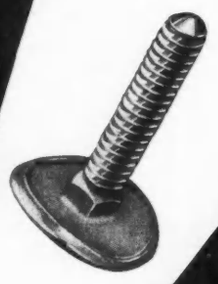
BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY
ELYRIA, OHIO

Bendix-Westinghouse
AUTOMOTIVE AIR BRAKES

WORLD STANDARD OF SAFETY

SPECIALS!





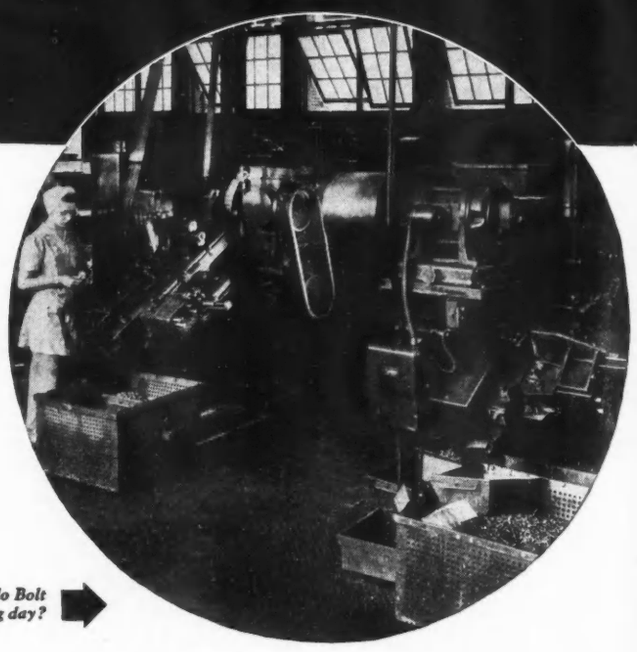
. . . convincing evidence of manufacturing skill

● Industry today, more than ever before, has a definite need for many different types of non-standard fasteners . . . fasteners of unusual sizes, shapes and materials . . . fasteners which must be custom-made to perform vital jobs in complex manufactured products.

Typical of these "specials" are the stainless-steel-headed bumper bolts illustrated above.

The fact that all circle Ⓑ fasteners are controlled from billet to bolt in one single plant—*the largest independent in the country*—naturally makes the Buffalo Bolt Company the logical starting point for any producer with a nut or bolt problem.

Standard or special, all circle Ⓑ products have the same uniform controlled quality that serves to make your production more efficient . . . less costly.



DID YOU KNOW *that each of this battery of Buffalo Bolt roll threaders has a capacity of* 43,000 *bolts per working day?*

BUFFALO BOLT COMPANY

NORTH TONAWANDA, N. Y. • SALES OFFICES IN PRINCIPAL CITIES

Export Sales Office: Buffalo International Corp., 50 Church Street, New York City

Wherever you go, you hear **MORE DESIGNERS** talking of using **MORE ALUMINUM** for **MORE THINGS.** Why?

Because American manufacturing has gone Modern—and Aluminum *is* Modern —the two go hand in hand.

That's why Smelters are producing closely controlled Aluminum Casting Alloys at three times the pre-war rate—and the trend is upward.

Many designers consult our Members for authoritative information about the best types of Aluminum Alloys for all casting applications.

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S.S.WHITE FLEXIBLE SHAFTS

give "PLACEABILITY" to accessories and controls

TYPICAL AUTO APPLICATIONS S.S.WHITE FLEXIBLE SHAFTS

- Spotlight Control
- Telescoping Antennas
- Trip Mileage Reset
- Heater Control
- Choke and Needle Valve
- Radio Tuning
- Clock Reset
- Windshield Wiper
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- Engine Governor Control

"Placeability" is a word we coined to represent an important advantage you get when you use S.S.White flexible shafts in conjunction with any accessory requiring power drive or remote control.

The shaft serves to give you full freedom in locating both the accessory and its control. You can place the accessory where you want it to satisfy space, operating and servicing requirements. And you can also put the control knobs where they are most convenient to manipulate.

The "placeability" that is gained through the use of S.S.White flexible shafts, opens up new possibilities in automotive design.

For basic information and engineering data about S.S.White Flexible Shafts and their application—

WRITE FOR BULLETIN 4501

S.S.WHITE INDUSTRIAL DIVISION

THE S. S. WHITE DENTAL MFG. CO. DEPT. A, 10 EAST 40th ST., NEW YORK 16, N. Y.

ARMY ★★ E ★★ NAVY

FLEXIBLE SHAFTS • FLEXIBLE SHAFT TOOLS • AIRCRAFT ACCESSORIES
SMALL CUTTING AND GRINDING TOOLS • SPECIAL FORMULA RUBBERS
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ROCKFORD
Hy-Draulic
MACHINE TOOLS

Over sixteen years ago the Rockford Machine Tool Co. introduced the first hydraulic reciprocating machine tool. Today our belief in the superiority of hydraulic design stands justified, for Rockford Hy-Draulic Machine Tools have proved themselves wherever and however employed. The exclusive and highly specialized engineering experience that has been ours is fully applied in each machine tool we build.

Every Rockford Hy-Draulic Machine Tool offers such important fundamental advantages as:

1. Ease of control for quick set-up and fast operation.
2. Stepless Speeds . . . infinitely adjustable throughout a wide specified range. Hy-Draulic tool-head feeds similarly adjustable.
3. Efficient, smooth hydraulic pressure . . . maintains cutting speed as set, no matter how work resistances may vary.
4. Smooth, fast reversals and high return-stroke ratios. Oil flow through Hy-Draulic System is instantly reversible. Simplicity of Hy-Draulic System holds inertia factors to a minimum.
5. Fine finish and long tool life. Smoothness of Hy-Draulic drive, free of mechanical play and vibration, protects work and cutter.

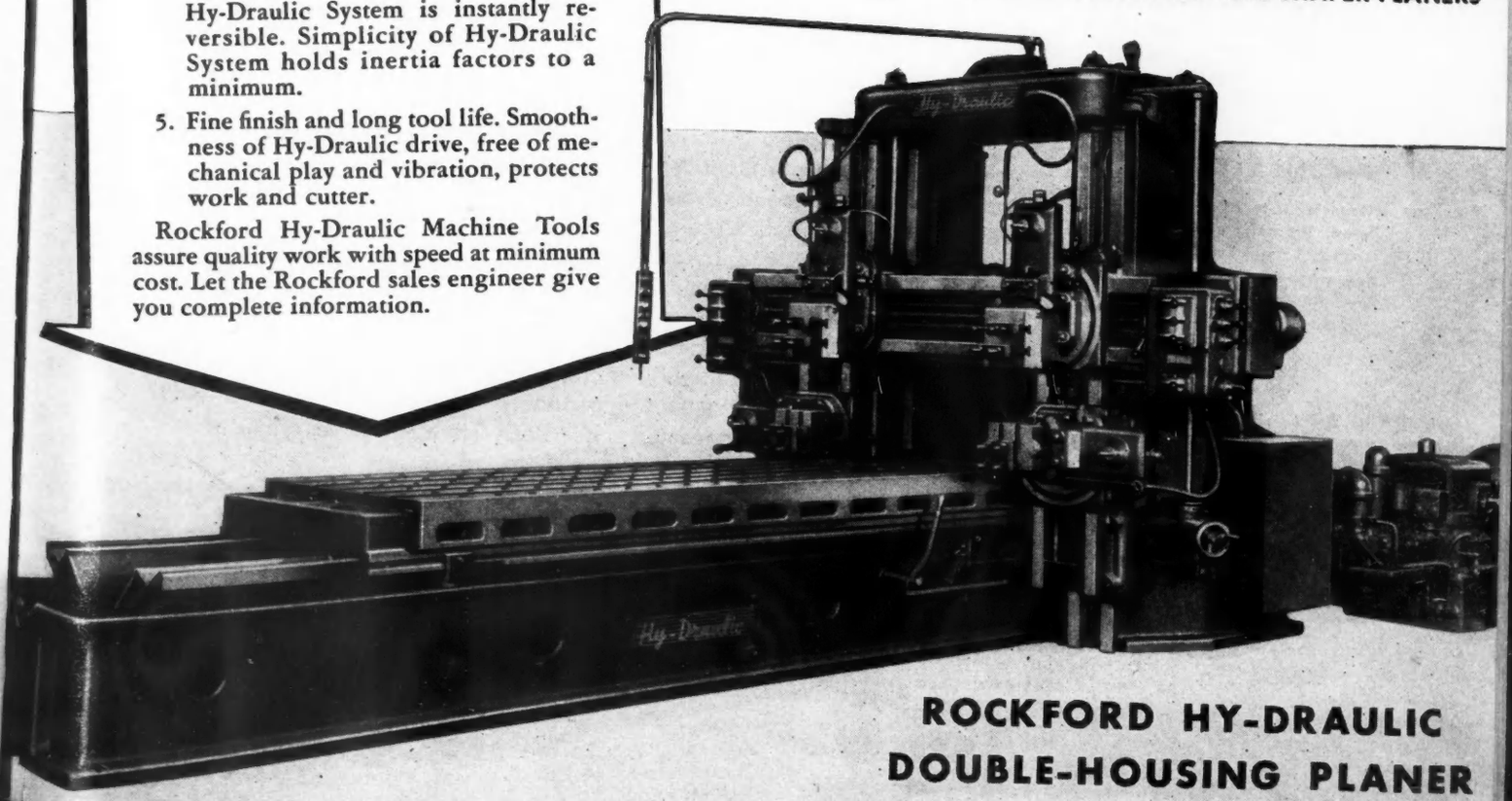
Rockford Hy-Draulic Machine Tools assure quality work with speed at minimum cost. Let the Rockford sales engineer give you complete information.

low bridge

With the cross rail snuggling the top brace, this Rockford 48″x48″ Hy-Draulic Double-Housing Planer is handling a 46″ high, five ton casting with speed, ease and accuracy. On the particular job shown, set-ups require stroke lengths of as little as 8″, with the tool heads feeding across the entire width of the casting. Hy-Draulic drive can take work like that in stride without sacrifice of speed in either cutting stroke or reversal. Rigidity of Rockford Planer construction is also demonstrated here; work is smooth and accurate although the cross rail is raised to near-top position.

Rockford Hy-Draulic Double-Housing Planers are built in four standard sizes, from 36″x36″ to 60″x60″, each size is available in six maximum stroke-length ratings ranging from 10 feet to 20 feet. You are invited to write for complete information on these machines. Ask for Bulletin 2618

ROCKFORD MACHINE TOOL CO.
ROCKFORD, ILLINOIS
Hy-Draulic
SHAPERS·PLANERS·SLOTTERS·SHAPER-PLANERS



ROCKFORD HY-DRAULIC DOUBLE-HOUSING PLANER

BESLY'S experience can help you

TO CUT COSTS OR IMPROVE FINISH

with BESLY-TITAN abrasive wheels

Above: Besly-Titan Resinoid-Bonded Abrasive Wheels for periphery grinding.

At right: Besly Steelbacs—the modern wheels that are usable to the last small fraction of an inch.

Quickly available to you is the accumulated experience of Besly engineers gained in fifty years on various types of grinding operations—intensified through recent years of high production. What may be a problem for you, may recently have been answered for some other manufacturer with new methods and techniques.

Besly-Titan Wheels made of resinoid bond only, assure smoother, better finish, often without resorting to a finer grit. The semi-elastic nature of Resinoid bond permits operation at high speeds with perfect safety. This bond is flexible and holds the grains just long enough, thereby making for long-lived wheels.

Another innovation—Besly Steelbacs can be worn right down to the steel backing or nuts . . . No abrasive is wasted. Perforations aid in making Steelbacs cool cutting. Resinoid bond permits the use of abrasive grains blended in endless combinations. All shop tests prove the high efficiency and outstanding economy of Steelbacs. Write today for information on Steelbacs and other Besly-Titan Abrasive Wheels.

Get This NEW CATALOG!

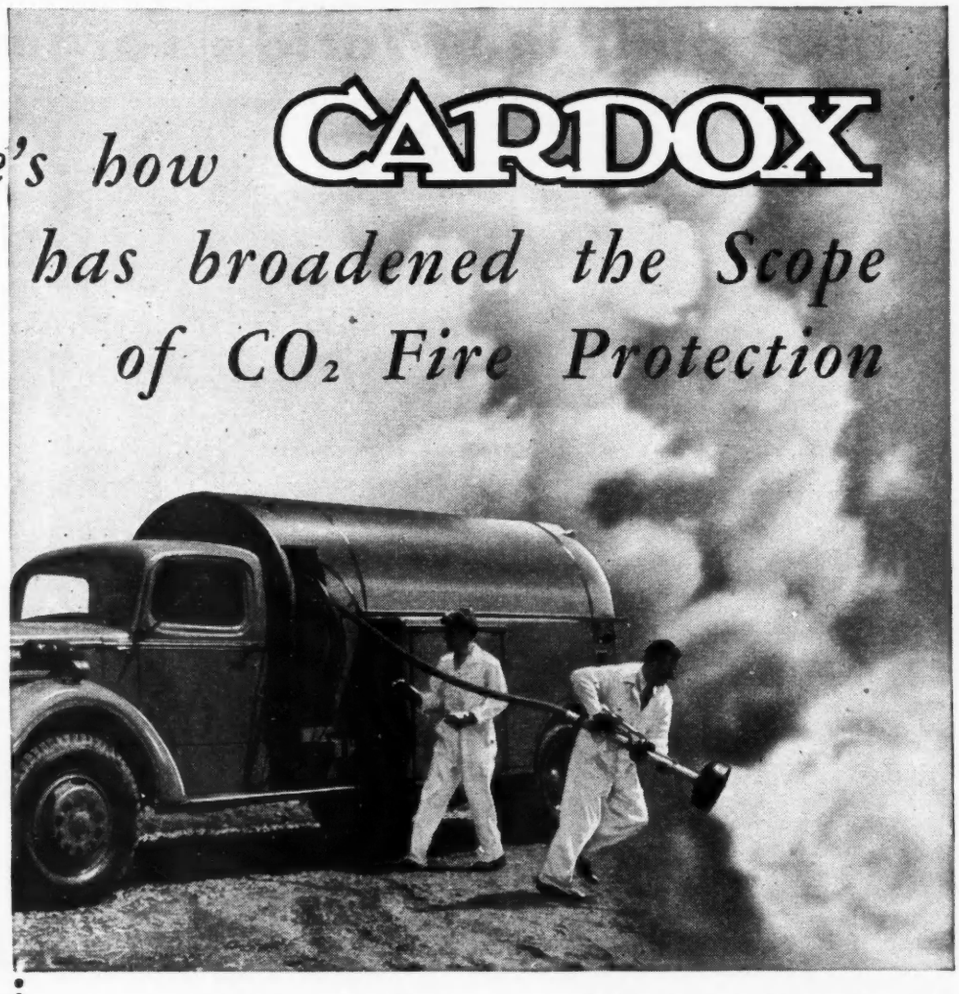
Write for it today—on your letterhead. It's new, up-to-date, practical . . . a ready reference on grinding wheels—illustrated by photos and diagrams. Ask for your copy at once.

BESLY

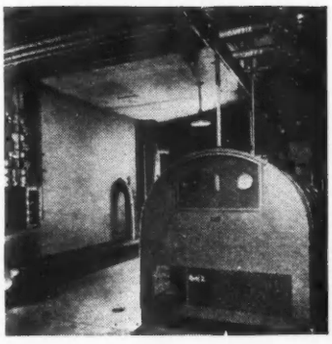
BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

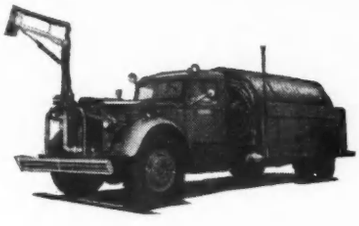
CHARLES H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.

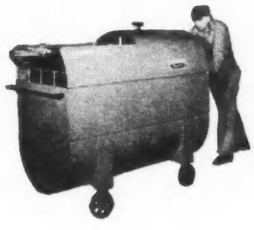
Here's how CARDOX *has broadened the Scope of CO_2 Fire Protection*



Typical Examples of Cardox Fire Fighting Equipment







(1) Cardox Fixed Systems. Provide 500 pounds to 125 tons of liquid carbon dioxide. **(2) Cardox Fire Trucks.** Tons of CO_2 on wheels for application through hose lines or standpipe systems. **(3) Cardox Airport Fire Truck.** Uses mass attack to overwhelm vicious crash fires fast. **(4) Cardox Transitank.** Portable unit with a capacity of 750 pounds of carbon dioxide. Now available in certain parts of the country in hand propelled, and motorized models.

Expert fire fighters, who have seen Cardox Fire Fighting Equipment in action against fires normally hard to stop, rate the Cardox method of control and application of carbon dioxide a *significant* contribution to the whole field of fire protection.

As a result of this unique Cardox method, Cardox can engineer many types of fire extinguishing equipment utilizing *low pressure* liquid carbon dioxide in *pounds* or *tons* to provide protection for hazards indoors or out. As a result, the applications for which the recognized advantages of carbon dioxide are now practicable have been multiplied.

For example, Cardox methods of application and control have made it entirely practical to use this fast, non-damaging medium, (1) To provide tons of Cardox CO_2 on a high speed truck to guard widely scattered hazards, (2) To provide a single system capable of protecting multiple hazards throughout large plants, (3) To equip factories, hangars, etc. with a *portable unit* with sufficient wallop to deal with relatively large fires, (4) To protect banks of large transformers outdoors, (5) To overwhelm vicious airplane crash fires fast anywhere on large airfields . . . making possible speedy rescue of plane personnel and salvage of costly equipment.

All Cardox Fire Fighting Equipment has one characteristic: *The distinctive Cardox method of control and engineered application of carbon dioxide stored at 0° F. and 300 p.s.i. in a single storage unit containing from ¼ ton to 125 tons of fire-destroying Cardox CO_2 . . . enough to handle even large fires and leave an ample reserve for new emergencies.*

Mail coupon today for details on how Cardox's broadened application of carbon dioxide can best be utilized to increase the protection of your specific operation. Write for Bulletin 466.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices in **New York • Philadelphia Washington • Pittsburgh • Cleveland • Detroit Cincinnati • Houston • San Francisco Los Angeles • San Diego**

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION
Bell Building, Chicago 1, Ill.

Send Bulletin No. 846 and full details on Cardox_____

*Name & Title*_____

*Firm Name*_____

*Street*_____

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They built the World's Largest Trailer

Bethlehem's Mayari* R

*Mayari rhymes with "fiery". R denotes rust resistance.

This lumbering 64-wheel trailer was designed to carry the biggest load ever moved on pneumatic tires—300 tons. Pushed and pulled by Army tanks, the secret load was moved into a Western desert during the war. Its wheels shod with special rubber tires, the trailer is more than 39 ft. long, 17 ft. wide, and weighs 73 tons. Its speed, carrying the load on a rough, sandy road with tires inflated at 39 lb. pressure, is 3 m.p.h.

Engineers calculate that, traveling at 1 m.p.h. with tire pressure raised to 90 lb., the trailer could transport a 556-ton load over an improved road.

If you were designing so heavy and powerful a vehicle, what material would you specify? The builders of this one—Rogers Bros. Corp. of Albion, Pa.—had to save every possible pound of deadweight while obtaining necessary strength to move the load over soft sand. So they chose Mayari R, Bethlehem's low-alloy, high-strength steel. Deflection in Mayari R beams carrying the heavy load was only 3/32 in.

Readily fabricated, easily welded, Mayari R proved ideal for the job—as it does in a great variety of applications where extra strength and reduction in deadweight are important.

BETHLEHEM STEEL

Mayari R *makes it lighter... stronger... longer lasting*

Mechanically New!

CENTRAL 360° WIRE HOSE CLAMP

5 STAR FEATURES!

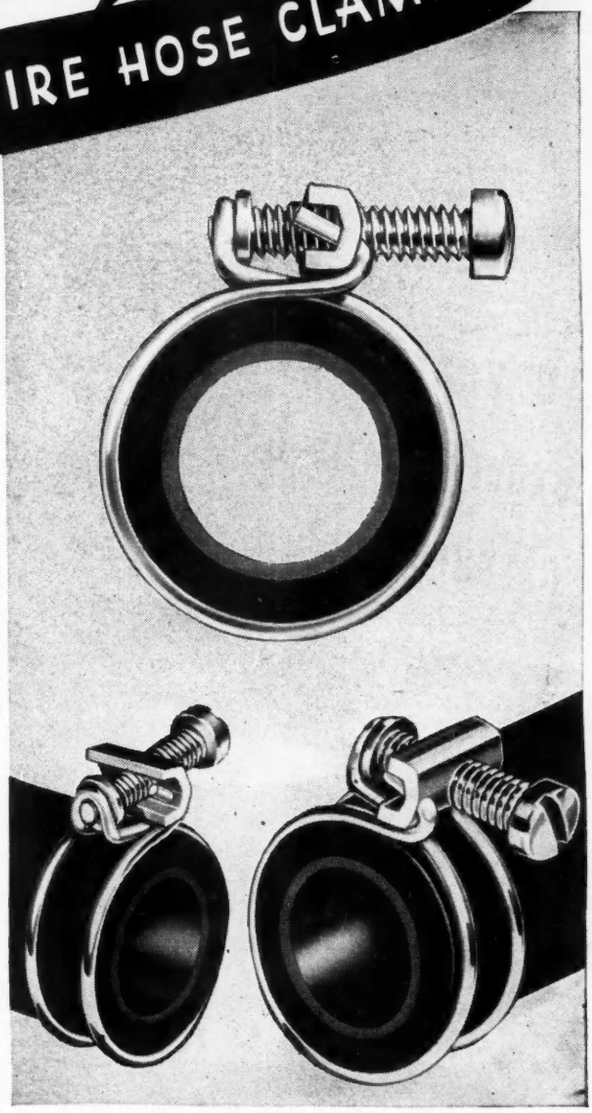
★ **PUSH + PULL POWER!** LOOK how the new, perfect mechanical principle of push plus pull clinches this clamp's powerful wire strands into a vise-like grip on the hose.

★ **RUGGED STRENGTH!** SEE how every part of the 360 is "oversize" for extra strength. For instance—compare the driving power of powerful screw with that found on the ordinary hose clamp.

★ **NO BLIND SPOT!** THE ABSENCE of a "tongue," found in all other clamps, completely eliminates the "blind," or "soft" spot—the primary cause of leakage in other clamps.

★ **A PERFECT CIRCLE!** DON'T OVERLOOK how, because of the new push plus pull principle, terrific pressure is exerted on every point, without damage to the hose. This 360 degree grip is positive leakage prevention.

★ **UNUSUAL TAKEUP!** COMPARE the exceptional takeup of the 360 with that of the ordinary clamp. This more than sufficient takeup guarantees elimination of leakage trouble, even on today's irregular synthetic hose.



Study the unique push + pull power of this sturdy clamp . . . and you'll discover WHY it HOLDS and HOLDS and HOLDS.

CENTRAL HOSE CLAMPS are now being successfully used by General Electric, International Harvester Company, Mall Tool Company, Waukesha Motor Company, Chrysler Corporation of United States and Canada, Chris-craft and many others.

CENTRAL EQUIPMENT CO.

902 S. WABASH AVENUE • CHICAGO 5, ILLINOIS

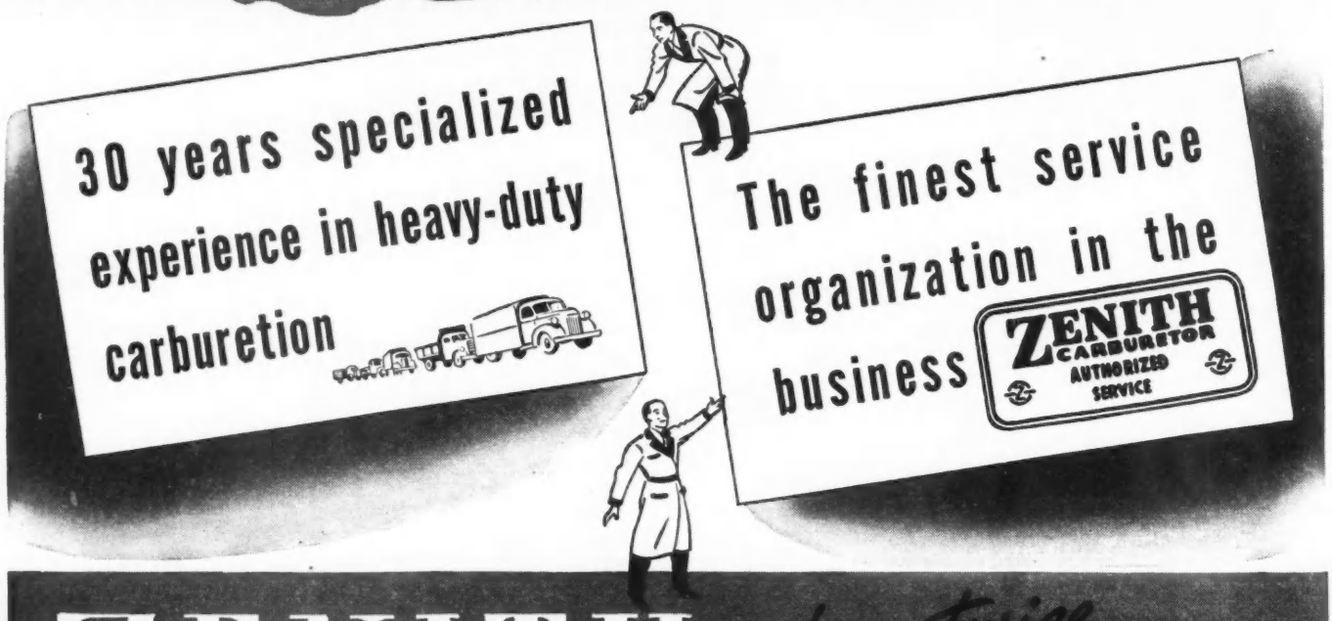
CENTRAL EQUIPMENT CO.
902 S. Wabash Avenue . . . Chicago 5, Ill.
Gentlemen: Please send FREE sample of your 360° Hose Clamp and your Bulletin No. 6100.

Name.....

Address.....

City.....State.....

NO MATTER HOW YOU LOOK AT IT!


30 years specialized experience in heavy-duty carburetion
The finest service organization in the business
ZENITH CARBURETOR AUTHORIZED SERVICE

ZENITH CARBURETOR

has twice the value at the cost of ONE!

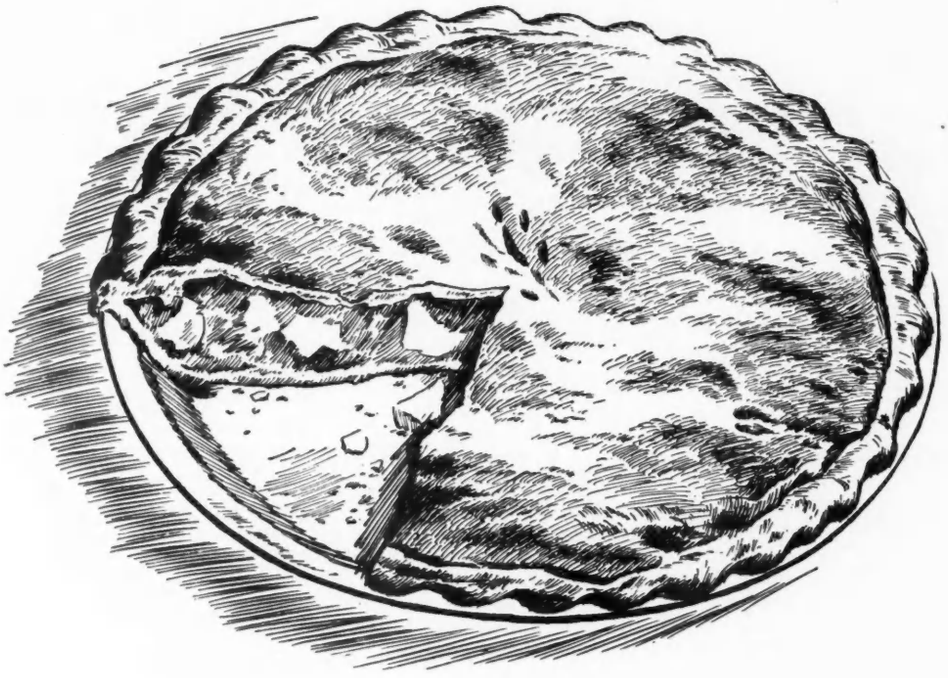
There are two ways to look at your carburetor problem. First, be sure your carburetion is designed specifically for your heavy-duty equipment, and that it will provide *trouble-free*, economical performance. Secondly, look at the service angle—to make sure that your trucks and buses are where they belong, on the road making money, rather than laid up for costly repair delays.

With Zenith* you can be sure you have made the right choice on *both* counts. For Zenith carburetors are designed and built to the highest standards in the industry, and backed by 30 years of specialized heavy-duty carburetion experience. And the Zenith *Service* Organization is also unsurpassed in the field—a vast organization of carburetor specialists, working with up-to-the-minute methods and modern equipment—and within reach of your telephone! Contact your local Zenith distributor and find out why experienced truck and bus operators rely on Zenith.

*REG. U.S. PAT. OFF.

ZENITH CARBURETOR Division of **BENDIX AVIATION CORPORATION**
696 Hart Avenue, Detroit 14, Michigan

PRODUCT OF Bendix AVIATION CORPORATION



As American As Apple Pie

JUST as apple pie is the favorite American dessert, so is contract manufacturing the American way of making more things, better, faster and at lower cost.

Contract manufacturing is known to have been profitably used in the United States as early as 1799. It was nurtured and expanded with the growth of American mass production. It flourished to an all-time high when our country needed arms of war. It is made possible by America's genius in producing precision parts that may be readily assembled even when picked at random. Contract manufacturing has become a sound and proven principle of American industry.

Hupp is an experienced contract manufacturer. Its wealth of experience in high production methods stems from more than thirty (30) years' experience in manufacturing automobiles.

This experience is now being utilized by many leading manufacturers in several industries. The executives of these companies believe in the Hupp Plan for Industrial Stability—believe that over-expansion today may prove costly, even disastrous, when the business curve levels off.

Through its Detroit Hupp Machining Division and its Cleveland Globe Stamping Division, Hupp maintains a pool of flexible production capacity under experienced engineers and sound management. Hupp can gear itself to your production schedule.

If your production or marketing involves specification stampings or precise machining of parts, call HUPP—AN EXPERIENCED CONTRACT MANUFACTURER.

HUPP
MOTOR CAR
CORPORATION
★
HUPP MACHINING DIVISION - DETROIT
GLOBE STAMPING DIVISION - CLEVELAND

ONE IN A SERIES OF ADVERTISEMENTS PRESENTING THE HUPP PLAN FOR INDUSTRIAL STABILITY

STANDARD SHAPES OF
REVERE MAGNESIUM
MAKE THESE BODIES 1500 lbs. LIGHTER

BUILT BY Barry and Baily Company in Philadelphia *without previous experience in working with magnesium*, these panel bodies for American Stores Company weigh approximately 1500 pounds less than similar bodies of steel!

Standard shapes of magnesium alloy, especially engineered by Revere and readily available from stock, make possible this remarkable advance in truck bodies. Now, for the first time, body builders and fleet operators can use magnesium with the same ease as steel. All sheet metal forming is eliminated through this Revere development. Structural members are all pre-designed in accordance with the engineering properties of high-strength magnesium alloys. None but familiar methods of fabrication and assembly are involved . . . clamping, drilling, riveting.

Full Latitude for the Body Designer. Bodies built with these standard materials may be large or small, may include any type of floor desired, may conform to individual designs, may be mounted on any make of chassis.

From the illustrations of this body under construction by Barry and Baily, you can see how simply and neatly the specially engineered Revere parts go together. The standard members consist of extruded floor beams, corner posts, crown sill sections, side posts and roof carlines, structural angle section, roof corner castings, and sheet for all exterior panels.

Dent-Resisting Corner Post. Two features are especially noteworthy and are shown here in detail. One is the composite corner post design. The inner post is a rugged member with a protrusion at its center running its entire length. This supports the strong outer shell at its most vulnerable point, and entirely eliminates the need for hand-fitted wooden reinforcing blocks. Because this post provides a smoothly rounded corner, the sheet for exterior paneling need only be fastened flat between the inner and outer members by means of rivets.

A Rugged Roof Rail. Not only is the roof rail exceptionally sturdy to resist abnormal punishment in service, but it securely unites side, end and roof panels into a rugged, unified structure of excellent appearance because of the generous radii employed. A decorative top trim designed as a scuff rail serves to ward off overhanging obstacles that might damage rivet heads. The roof corner is a massive magnesium alloy casting. This, as well as side posts, roof carlines and reinforcing angle sections, are all joined to the roof rail with machine screws or bolts.

Let Revere Help Lighten Your Equipment. Revere's standard magnesium alloy shapes have been engineered to make the building of ultra-light panel bodies simple, easy and inexpensive. But truck bodies are only one type of equipment which Revere magnesium can lighten. In collaboration with your own engineers, a Revere Technical Advisor will gladly assist in the application of magnesium to your products. That is the way to get more payload into your transportation equipment . . . on the ground or in the air.

For full details on Revere's standard magnesium alloy shapes for truck bodies and on other Revere magnesium products, get in touch with the nearest Revere office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

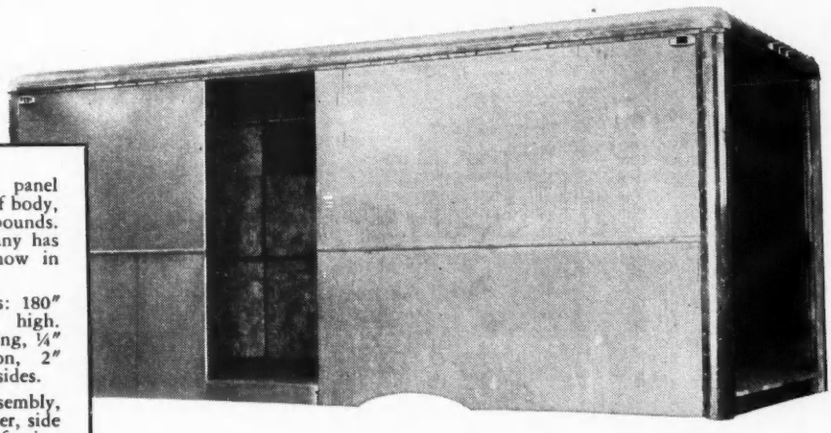
230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in Principal Cities

• • •

Listen to *Exploring the Unknown* on the Mutual Network every Sunday evening, 9 to 9:30 p. m., EDST.



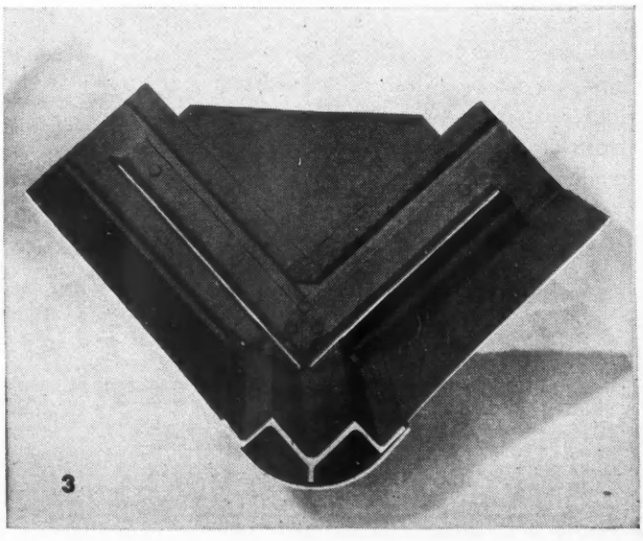
(1) 5-ton American Stores panel truck. Finished weight of body, approximately 2100 pounds. American Stores Company has two of these trucks now in service.

(2) Inside body dimensions: 180″ long, 86″ wide, 75″ high. Flooring, 1⅛″ oak. Lining, ¼″ fir plywood. Insulation, 2″ fiberglass in roof and sides.

(3) Detail of roof rail assembly, showing roof rail member, side post, roof carline, reinforcing angles and corner casting as seen from inside.

(4) Detail of corner post assembly showing how side and end panels are riveted to the composite corner member.

1



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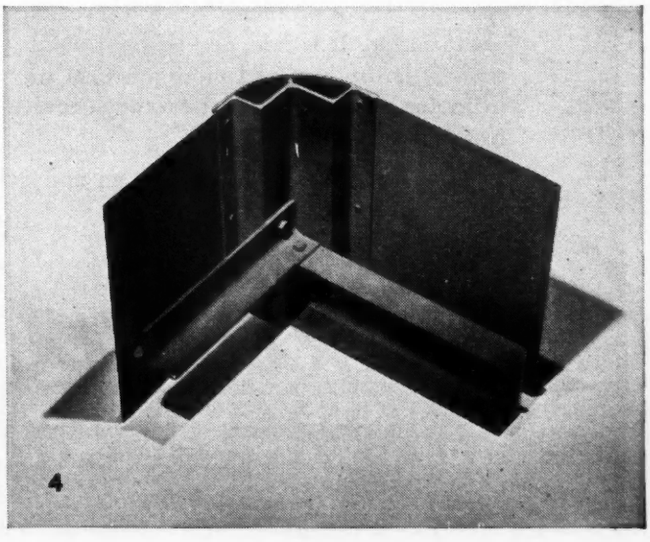

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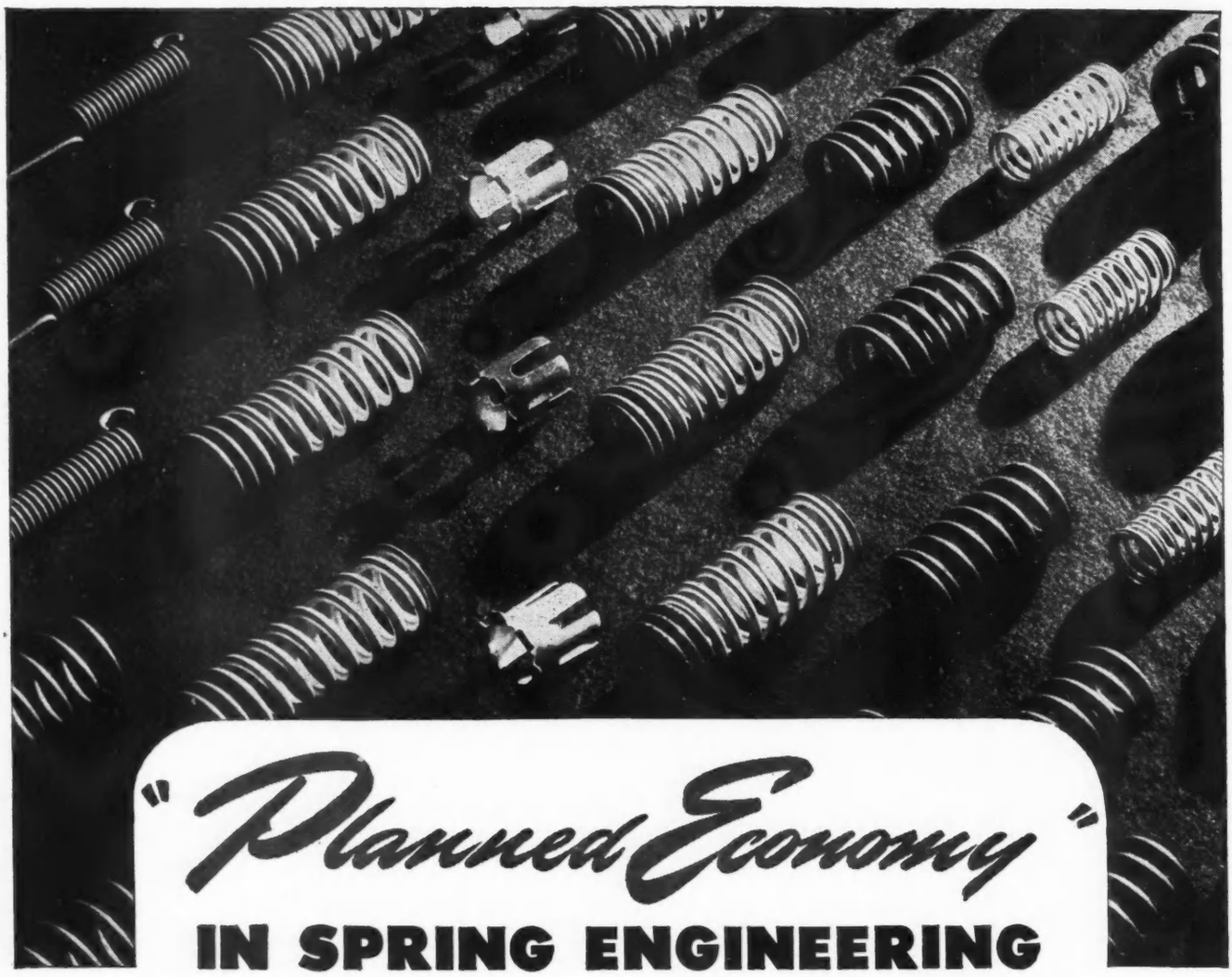


"Planned Economy" IN SPRING ENGINEERING

The Design Service rendered by Cleveland Engineers is a kind of "Planned Economy" which has no antagonists, because it is merely the application of sound engineering principles and ripe experience to the design and manufacture of springs.

It begins when you submit your spring specifications or problems to the "Cleveland" organization. It is free, and without obligation. It is the best and most practical way to insure permanently satisfactory service from all springs.

In hundreds of cases it has put an end to spring troubles resulting from rule-of-thumb design, or too much dependence on precedence. The service is aimed at the production of the simplest, least expensive springs which will give the desired troublefree service in any given application. It is a kind of "Planned Economy" everybody can be enthusiastic about.

Send us your blueprints and specifications now, before new designs are frozen, so that indicated improvements in spring design, working space, and related details may be made with the least trouble and expense.

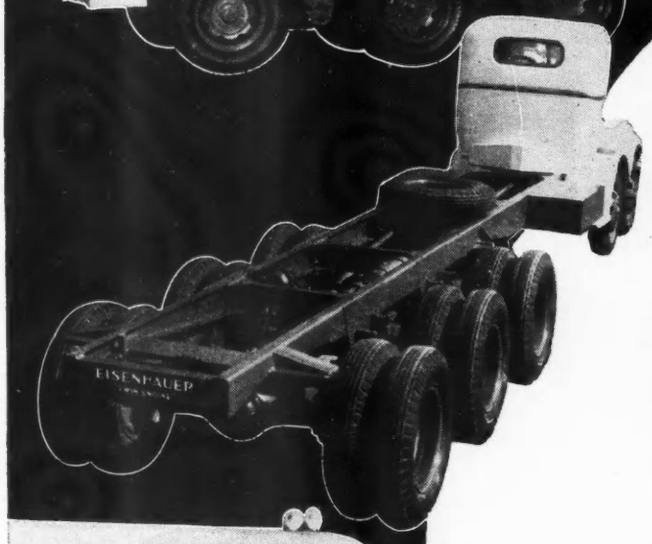
Cleveland SPRINGS

CLEVELAND WIRE SPRING CO.

2012 West 25th Street, Cleveland 13, Ohio

Subsidiary: Reynolds Spring Company, Jackson, Mich.

2 ENGINES 5 AXLES 20 TONS and MIDLAND POWER BRAKES



Unique — NEW
EISENHAUER
Heavy Duty Truck
is
MIDLAND EQUIPPED

ENTIRE AIR SYSTEM FOR BRAKES, SHIFTING OF 2-SPEED AXLES AND LOCKING OF SHIFTABLE AXLE CONTROLLED BY MIDLAND

Made from two 1½-ton Chevrolets, this unique twin-engine truck has four front steering wheels, three flexible rear axles, an overall length of 35 feet and a pay-load capacity of 20 tons. The 10-wheel brakes are Midland air-over-hydraulic type.

This same Midland engineering "know how" is at your service in Midland standard air or vacuum power brakes — assuring you efficient, economical service. Consult a Midland distributor, or write to us for complete information about Midland equipment.

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Our enlarged plant facilities make it possible for us to consider the manufacture of a few items in household or office appliance, automotive or mechanical fields. We invite inquiries to Midland New Products Dept. at the above address.

MIDLAND
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POWER BRAKES

Keep Your Alloy Investment Working With

THERMALLOY

X-RAY CONTROLLED *heat resistant* CASTINGS

POTS MUFFLES BOXES BASKETS TRAYS CHAIN

Dependable Service

in alloy castings is predicated on many important production factors.

Proper design—correct analyses—exacting metallurgical and X-ray control—and sound foundry practice are basic requisites for good castings.

The Thermalloy retort herewith illustrated, used for heat treating bolts and nuts up to 1800° F. is dependable.

LENGTH—10 FEET
DIAMETER — 26 INCHES
WEIGHT — 3262 LBS.

AMSCO ALLOY *and* THERMALLOY *are identical . .*

Thermalloy
ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO.
X-RAY CONTROLLED
AMERICAN Brake Shoe COMPANY
HEAT AND CORROSION RESISTANT CASTINGS

"No unhitching... no feeding!"

A full-color reproduction of this painting suitable for framing will be sent upon request

So claimed Charles Duryea for his horseless carriage. He had built it in a barn in Springfield, Massachusetts, and it was the first of its kind in the country.

It was the year 1892, when gasoline was to be bought by day at the hardware store and by night at the corner drug store. The new contraption had "two speeds forward and one reverse, and was operated by an up and down movement of the steering handle."

We have come a long distance since Charles Duryea's day. One measure of that distance is the universal use in motor vehicles of ball and roller bearings such as SKF produces. For SKF has contributed much to the automotive industry, and the presence of SKF Bearings is a warranty of quiet performance and low maintenance cost.

Since SKF makes many types of anti-friction bearings, an SKF engineer can give you expert help in selecting

THE RIGHT BEARING FOR THE RIGHT PLACE

SKF INDUSTRIES, INC., PHILA., PA.

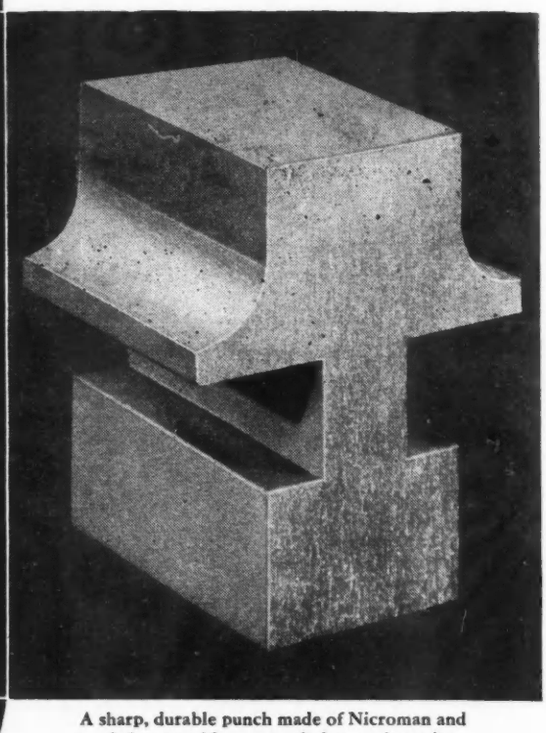
SKF
BALL AND ROLLER BEARINGS

7000-A

DISSTON NICROMAN

MIX 827

AN "ALL PURPOSE" TOOL STEEL OF EXCEPTIONAL TOUGHNESS



A sharp, durable punch made of Nicroman and used for punching out window sash sections

ANALYSIS

Carbon	.70%
Manganese	.40%
Silicon	.20%
Nickel	1.65%
Chromium	1.00%
Copper	.35%

BECAUSE of its versatility, many companies have adopted Nicroman for use in all their tools except those requiring high speed steel. It is extensively used for knives, chisels, punches, hammers, pins, stamps, dies, many others . . . and with unusual success.

In the Disston plant Nicroman is used on the shears of bar mills where many different shapes and sizes are handled, and of various degrees of hardness—.10% carbon iron, .90% carbon steel to 1.60% carbon file steels. Some are sheared hot, some cold, but Nicroman blades have proved equal to them all.

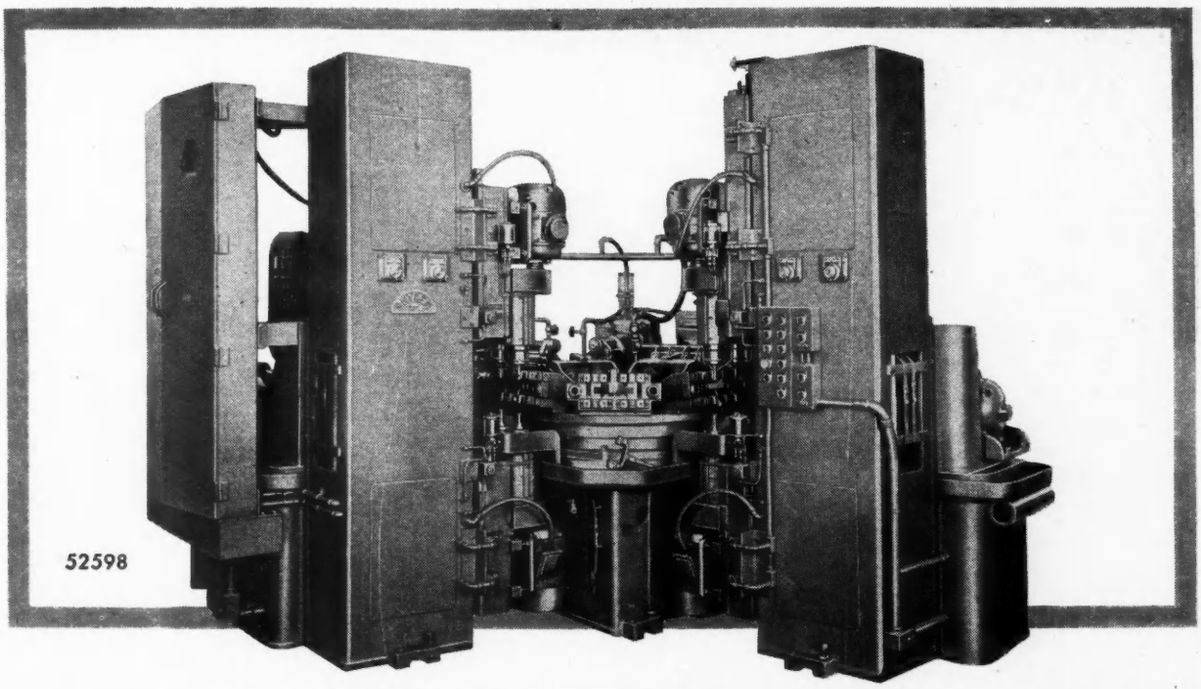
Nicroman combines the toughness and long wear of the best of the low alloy steels with the absence of distortion sometimes encountered with the regular high alloy oil-hardening steels.

A study of your tool steel needs will likely reveal many applications where Nicroman can be used to advantage. If so, you will be able to effect important savings in inventory stocks, avoid the misuse of brands, and simplify heat treating.

DISSTON ENGINEERS WILL BE GLAD TO HELP YOU SOLVE YOUR TOOL STEEL PROBLEMS

Whether your tool steel problems are simple or complex, Disston engineers and metallurgists will be glad to help you find the right solution. They will advise you frankly, without obligation, and in confidence.

HENRY DISSTON & SONS, INC., 631 Tacony, Philadelphia 35, Pa., U. S. A.

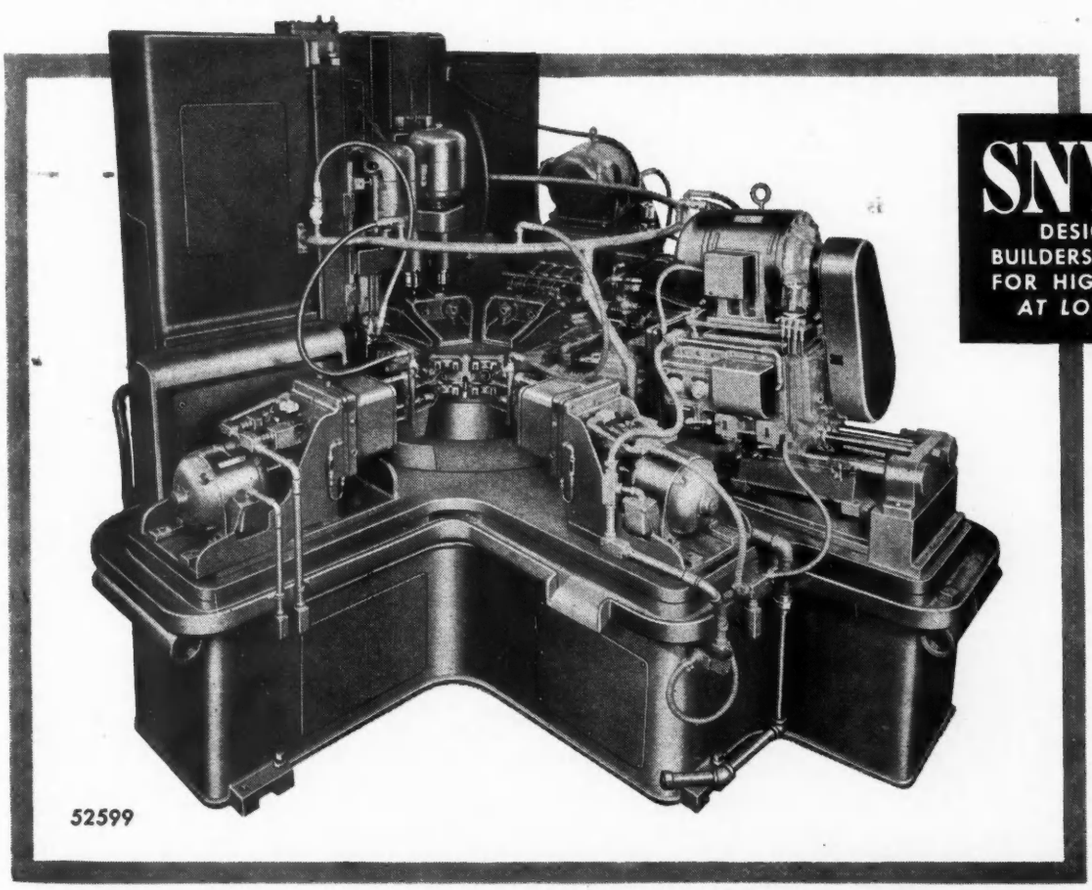


7-STATION *Snyder* SPECIAL for PROCESSING STEERING KNUCKLES

Designed and built by Snyder specifically for processing automotive steering knuckles, this special-purpose machine has an estimated production of more than 100 cycles an hour, or, over 200 parts, at 80% efficiency.

Each fixture on the seven stations clamps two parts—one left and one right. The operations performed are drilling, reaming, tapping and two-way rough and finish boring, these operations being performed by a series of units arranged around an automatically operated index table.

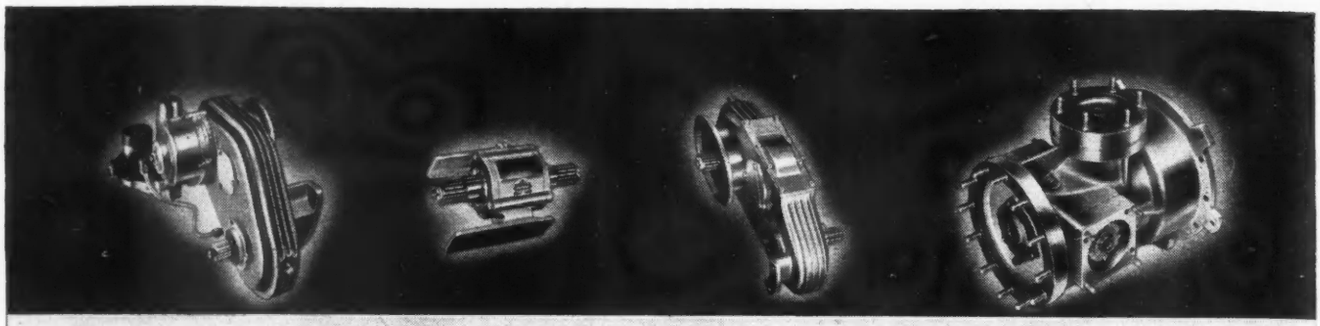
The automatic operation, reduction in handling and in operator fatigue, control of accuracy, finish and time cycle are typical of the advantages in Snyder special-purpose machines. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*



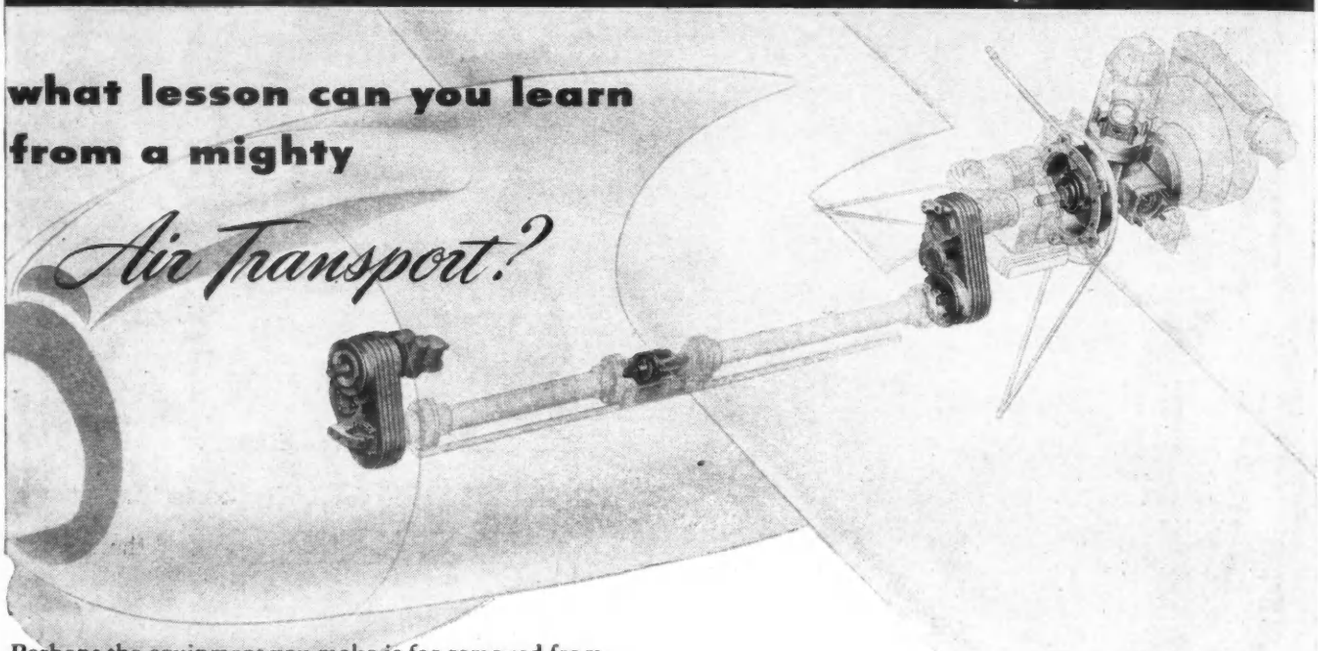
SNYDER

DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

21 Years of Successful Cooperation with Leading American Industries



what lesson can you learn from a mighty *Air Transport?*

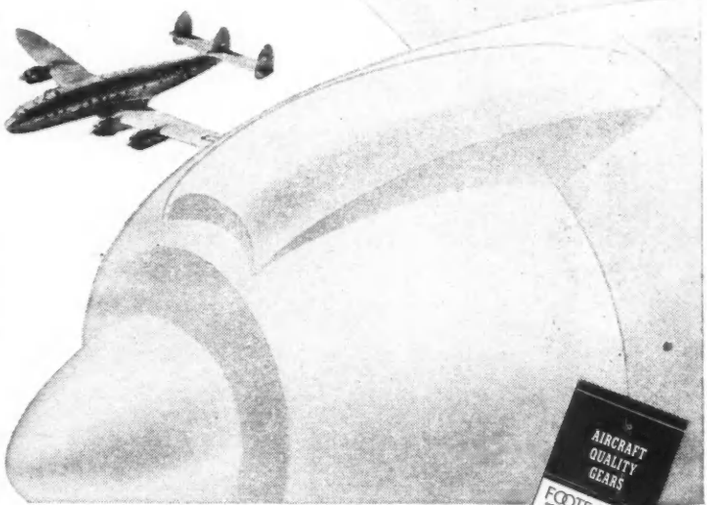


Perhaps the equipment you make is far removed from Lockheed air transports, but the successful solution of the application of power demonstrated in these airplanes may offer a suggestion to you. Power is transmitted from the engine through an assembly of Power Units. This assembly drives a generator, cabin supercharger, hydraulic pump and other equipment.

Foote Bros. Power Units provide a positive means of applying this power exactly where it is needed.

These compact units can actuate linear or rotary motion at remote distances from the operator. They are light in weight—compact in size to fit a confined space envelope—and can perform continuously or on a predetermined time cycle. They may be direct connected to the power source—operated through a flexible shaft—or powered by an integral motor.

Many manufacturers have found that Foote Bros. Power Units provide a successful solution to power transmission problems. Their use on the equipment you manufacture may mean a better product. Our engineers will gladly work with your designers.



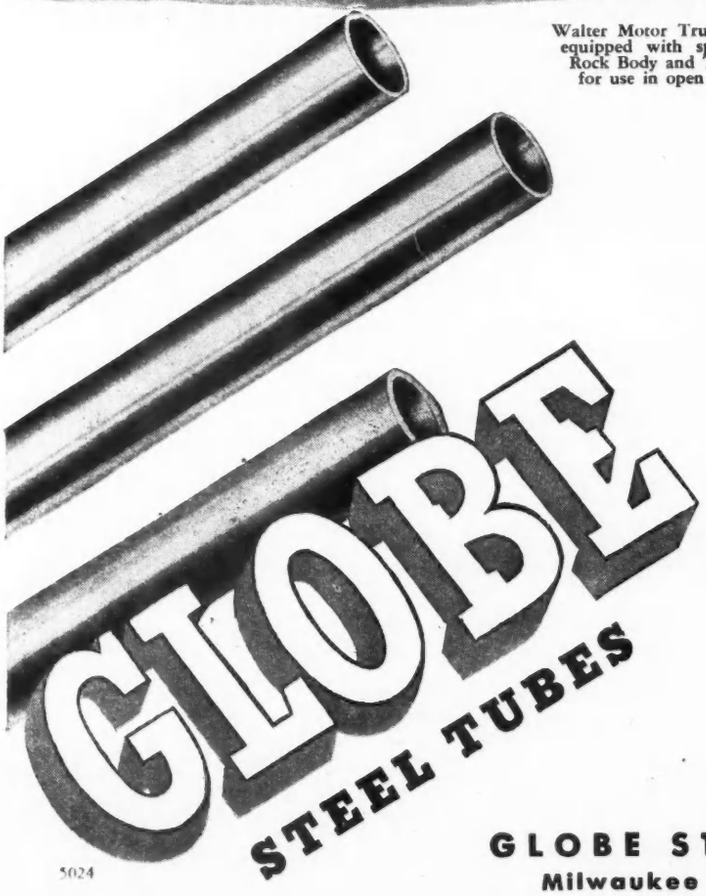
FOOTE BROS. GEAR AND MACHINE CORPORATION • 5225 S. WESTERN BLVD. • CHICAGO 9, ILL.

FOOTE BROS.

Better Power Transmission Through Better Gears

A recently issued bulletin on Power Units giving complete engineering data on "packages of power" will be sent on request. Also available is a bulletin on Aircraft Quality Gears. Write for your copies today.

Walter Motor Truck, Model AC-VD, equipped with special 12 yard Heil Rock Body and Twin Telescopic Hoist for use in open pit iron mine handling.



"MECHANICAL muscles" just don't "happen." Hydraulic pressures would be impotent without pressure-resistant channels to confine them. Mechanical tubing of adequate strength is an important part of hydraulic devices. Globe builds mechanical tubing that provides strength with light weight for hydraulic and many structural applications.

Here is another example of Globe's ability to supply tubing in a wide range of sizes, analyses, and types, for a variety of needs. And when you specify "Globe" you are sure of uniformity and quality in tubing —mechanical, pressure, corrosion resistant applications.

5024

GLOBE STEEL TUBES CO.
Milwaukee 4, Wisconsin, U. S. A.

GLOBE TUBES

★ STAINLESS STEEL TUBES ★ PRESSURE TUBES ★ GLOBEIRON TUBING ★ GLOWELD TUBES
★ CONDENSER AND HEAT EXCHANGER TUBES ★ MECHANICAL TUBING

PAGE for WIRE

WANTED — A single responsible source for round, flat and shaped wire—of high and low carbon steel, stainless steels and Armco iron. Also complete line of welding electrodes and gas welding rods.
A MANUFACTURER

Here's a Want Ad ✓PAGE Can Answer

Yes, and PAGE can go a step further than that. PAGE can give you the benefit of long experience in recommending the most efficient use of wire in production. Just remember three words: "PAGE for Wire."

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

Projecting Forward in these progressive times

THE LOGICAL LOCATION FOR YOUR AUTOMOTIVE OR AVIATION FACTORY

Located centrally at the crossroads of direct rail, air, and highway routes to all of the nation's richest markets. Where dry climate reduces costly storage deterioration. Pueblo has one of the army's largest depots, where vehicles and ordnance equipment are stored in the open.

PUEBLO COLORADO

Pacemaker Of The West

MILD FRIENDLY CLIMATE

Sunshine builds health 344 days a year. Summers are cool, winters mild. Mean temperature of 51.9

EXCELLENT WORKING CONDITIONS

This is already Colorado's Industrial City. One industry has the largest single payroll in the state.

FACTORY SITES AVAILABLE

There are still a limited number of preferred Industrial Properties available with rail trackage.

Write today on your letterhead for our informative twelve page brochure, "12 Points To Prosperity."

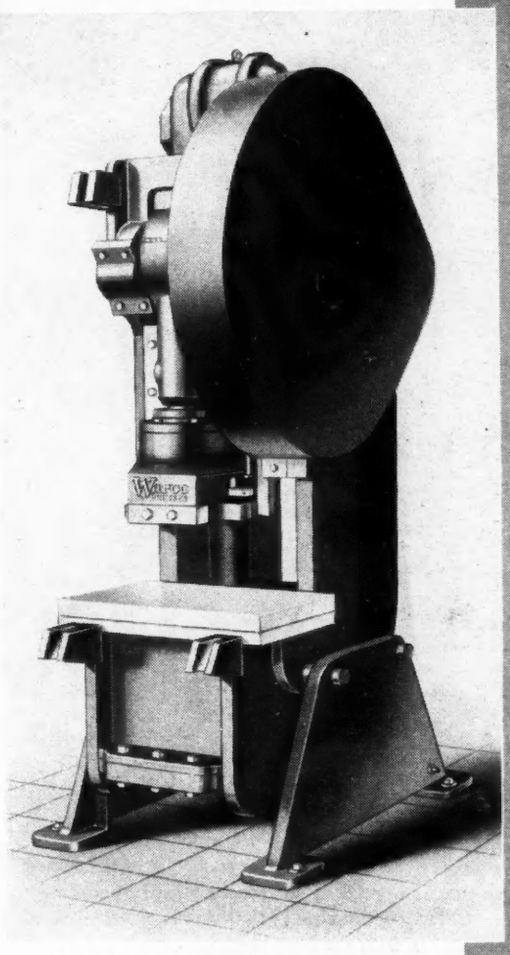
A CITY OF 81,696 POPULATION

Warco PRESSES

The Finest Line of

WELDED STEEL PRESSES

Weldments
Fully Stress-Relieved



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HYDRAULIC PRESSES

PRESS BRAKES

Don't Let Delayed Delivery Hold You UP

Our large production facilities place us in a better position than many others to give you prompt press delivery.

Warco welded steel presses are the most modern available —engineered to provide greater rigidity, accuracy, strength, power and endurance.

OBI PRESSES

Capacity range, 50 to 200 tons, stroke range, 4 to 14 inches, single geared, electrically controlled, latest type friction clutch and brake unit.

Your inquiry will receive immediate attention. We also invite you to pay a visit to our plant, the largest of its kind in the world.

WARREN CITY MANUFACTURING COMPANY
1962 Griswold Street • WARREN, OHIO
A Subsidiary of The Federal Machine and Welder Company
Offices in Principal Cities

THERE'S A *Saint* AMONG THE *Sinners*

● Choking is the simplest way to produce the richer fuel-mixture that is necessary for starting and operating a cold engine. *Automatic* choking is the easiest, most accurate and most economical kind of choking—*if it works.* It makes the required fuel-mixture adjustment mechanically and precisely as a part of the engine. Hand-choking—along with being inconvenient and usually wasteful—is guesswork at best—even in the hands of carburetor engineers and expert drivers.

Sisson Automatic Choke is the *only* fully dependable, *trouble-free* automatic choke . . . The Saint among the Sinners. It *works*—without fail. It never has to be cleaned. It never has to be adjusted (unless it has been the victim of tampering by an uninformed mechanic). It won't stick on any carburetor that is clean enough to be used at all. Barring tampering, it will outlast the car itself—without any attention whatever.

More than six million cars have been served by Sisson Automatic Chokes. The owners of those cars have no reason to be aware of the necessity for choking at all. In fact many don't even know there is a choke on the car. They simply step on the starter and go—cold or hot—snow or blow.

Sisson Automatic Choke Division
THE PIERCE GOVERNOR COMPANY, INC.
ANDERSON, INDIANA

ONE LOOK at this high-precision internal planetary gear (for a supercharger drive transmission) shows you why it calls for the best in precision production . . . why it's tough to carburize and harden to exacting specifications *without distortion.*

Outer diameter is 8¾" but the average rim thickness is only ⅛". The two internal gears and the outside rim are concentric with each other and round within .002" full indicator reading . . . total backlash limit is .002".

IGW's ability to create hard-to-make gears to exacting specifications is one reason why so many leading manufacturers today turn to IGW for a solution to their precision gear and other intricate parts problems. Read their "case histories" in Precision Doesn't Cost—It Pays! . . . yours for the asking.

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GEARS • CAMS • INTRICATE AND PRECISE MACHINE PARTS
INDIANA GEAR WORKS • INDIANAPOLIS 7, IND.

Automotive Die Steels AVAILABLE IMMEDIATELY from CRUCIBLE'S Detroit Warehouse

CALL: LAfayette 8200

AIRDI 150

Outstanding high-carbon, high-chromium, air-hardening die steel. Extremely resistant to abrasion. Very small change in size during hardening. Conforms to following specifications: Chrysler NP-2050; Ford CNS; General Motors 48-M.

SIZES: ROUNDS 3/8" to 7"; FLATS 3/4" x 1/2" to 6" x 4"; SQUARES 1/2" to 8".

AIRKOOL

Air-hardening carbon-chromium-molybdenum die steel. Tough, non-deforming, deep hardening. Fairly high in abrasion resistance, machines very readily. Conforms to following specifications: General Motors 100-M.

SIZES: ROUNDS 1/4" to 12 1/8"; FLATS 1" x 1/4" to 6" x 4"; SQUARES 1/4" to 8".

KETOS

Oil-hardening, non-deforming die steel. Gives deep hardening with fine grain structure for long service. Conforms to following specifications: Chrysler NP-2005; General Motors 46-M.

SIZES: ROUNDS 1/4" to 12"; FLATS 4" x 1/16" to 6" x 5"; SQUARES 1/4" to 8".

GRANADA

Water-hardening; used for blanking and forming dies. Conforms to following specifications: Chrysler NP-2001; Ford Type RR; General Motors 34-M (analysis). With vanadium, to Chrysler NP-2002; General Motors 38-M (analysis).

SIZES: ROUNDS 1/4" to 12"; FLATS 1/2" x 1/4" to 8" x 6"; SQUARES 3/8" to 10".

AUTOMOTIVE DIE STEEL

Water-hardening; used for blanking and forming dies. Conforms to following specifications: Chrysler NP-2001; Ford Type RR; General Motors 34-M (analysis).

SIZES: FLATS 2" x 1/2" to 8" x 6"; SQUARES 1" to 10".

•

Write for handy FREE DIE STEELS STOCK LIST

It gives you complete listing of sizes of rounds, flats, squares, in stock in all die steel grades, plus convenient weight tables and formulas.

CRUCIBLE STEEL COMPANY Full Range Service **of America**

SALES OFFICE AND WAREHOUSE
3245 Hubbard Avenue, Detroit 10, Michigan

Ample stocks of all grades, plus a full line of high-speed steels and tool steels, now in stock at our Detroit warehouse. Call Lafayette 8200 for information.

LARGE STOCKS OF TOOL AND DIE STEELS ALSO CARRIED AT OUR INDIANAPOLIS AND CINCINNATI WAREHOUSES.

Crucible Steel Company of America
Dept. G1, 3245 Hubbard Ave., Detroit 10, Michigan

Kindly send me a copy of the CRUCIBLE DIE STEELS STOCK LIST:

NAME_____ TITLE_____

COMPANY_____

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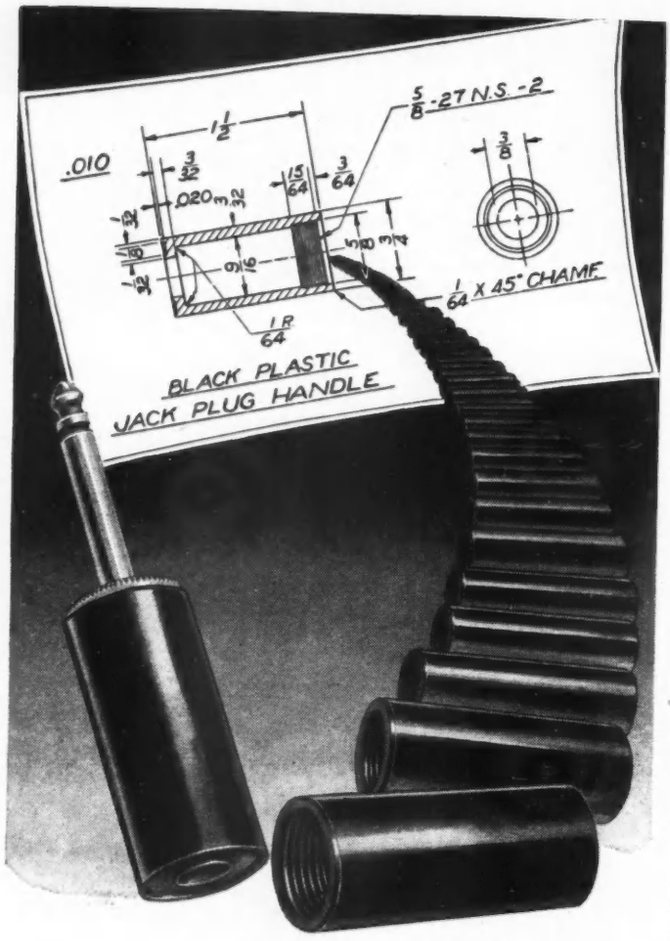
STATE_____



From Blueprint to 18,000 Per Day

in 9 Weeks and 2 Days

Here were the requirements—a quality thermosetting plastic part . . . a price ceiling . . . volume production . . . early delivery date. And we beat every one of them. How? The dies were made in our own die shop. Samples were submitted and immediate approval obtained. From the time dies were put into production molding rate reached 18,000 pieces per day within 3 days. Our engineers devised an ingenious machine in our own machine tool shop that would complete the four required finishing operations at one time.

It is this service, this know-how in devising ways and means to produce a better product at the lowest price consistent with quality work that is building HI-EFF volume. And what we are doing for others we can do for you. Taylor Manufacturing Co., 3092 W. Meinecke Ave., Milwaukee 10, Wis.

TAYLOR OF MILWAUKEE

CUSTOM MOLDERS OF HI-EFF PLASTIC AND RUBBER PARTS

AV-16 SERIES ELECTRIC MOTOR VALVES

for Gasoline, Hydraulic Oils, Lubricating Oils

AV-16 hits a new high in hi-g progress!

Most compact. Featherweight. Insures positive shut-off. Less current consumption. High flow capacity with minimum pressure drop. 100% safe, with explosion-proof housing. AN fluid and electrical connections. Write for complete engineering data and Catalog 52-B.

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Aluminum Bronze... Magnesium Bronze... and Cast Iron... the...

WILSON ELECTRODE NO. 200

The Wilson electrode No. 200 is a general-purpose, D.C. reverse polarity, aluminum bronze rod offering you highest-quality welding at low cost. Designed for flat and horizontal welding, it produces deposits having the desirable properties of aluminum bronze, especially its high strength . . . hot ductility . . . and corrosion resistance.

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For full information on Wilson No. 200 as well as other Wilson Electrodes, fill in the coupon for a copy of Catalog No. ADW 75 and mail it today or address your nearest distributor.

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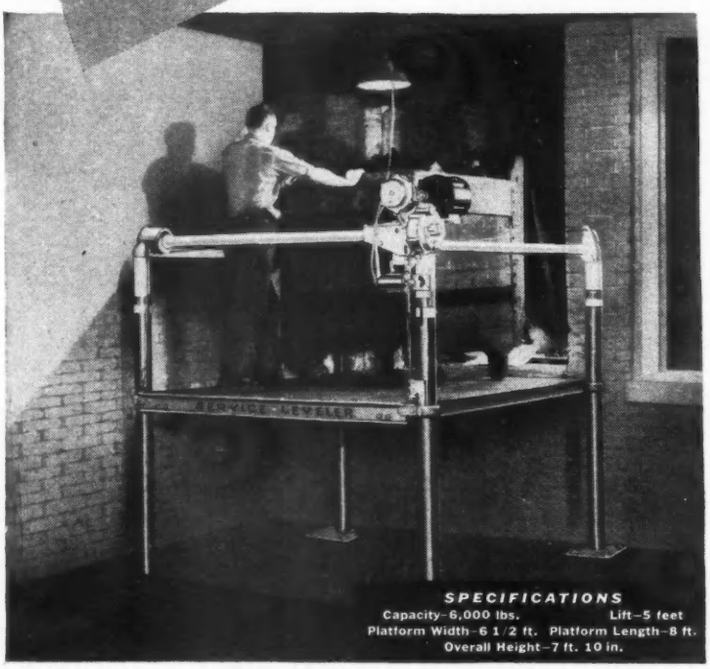
New! SERVICE Leveler

BRINGS NEW ECONOMY AND SAFETY TO HANDLING HEAVY LOADS FROM LEVEL TO LEVEL, FAST AND EASY...



SPECIFICATIONS
Capacity–6,000 lbs. Lift–5 feet
Platform Width–6 1/2 ft. Platform Length–8 ft.
Overall Height–7 ft. 10 in.

Now, do away with slow, dangerous, manual handling of loads from level to level! The new Service LEVELER, powered by a rugged, 1 H.P., fully-enclosed electric motor, lifts 6,000 pound loads up to 5-foot heights in less than a minute. Positive motor cut-off stops. Platform stops automatically at top and bottom of travel; convenient hand switch controls motor starting and permits stops at any height. Safety Governor and sturdy post Guard Rings prevent load dropping in event of accidental cable break. Cable Shut-off stops motor instantly if platform contacts any object carlessly left beneath it. Entire equipment is portable.

Install anywhere in a couple of hours at amazingly low cost. No sub-surface installation required. Prompt delivery. Shipped knocked down with complete erection instructions. Write for price and detailed specifications . . . . . .

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LIFTERS • CRANES
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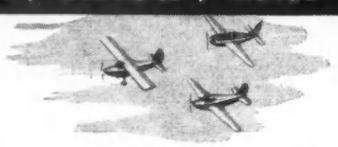
NOW
A New WITTEK Hose Clamp
For Personal Planes



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The great fund of aviation production knowledge developed during the war by aircraft parts manufacturers is now being turned to peacetime planes, commercial and personal. Wittek now offers manufacturers of these planes the FBP Hose Clamp.

The new Wittek FBP Hose Clamp, made from stainless steel and having a band ½" wide, follows the basic FB design, incorporating lighter construction and economy—yet retaining the high Wittek standards for dependability, high grade materials and good workmanship.

In addition to the FBP, FBSS and WWD, Wittek manufactures a complete line of Hose Clamps of various designs. There is a Wittek Hose Clamp to meet every aircraft application. Write for full particulars.

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Aviation HOSE CLAMPS

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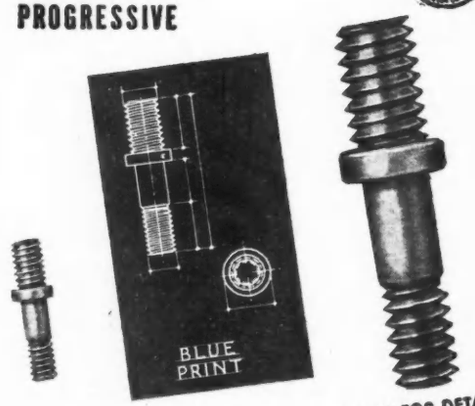

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Special heads, threads and finishes on any metal or alloy adapted to cold upset. Weekly output: 25,000,000 pieces. Many specials, suggesting production savings for you, illustrated in latest catalog. Includes weights per 1M standard pieces, dec. equivs. of fractions, other purchasing and engineering helps. Write for Catalog 18.

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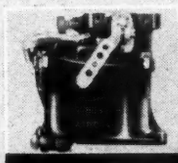

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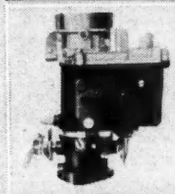

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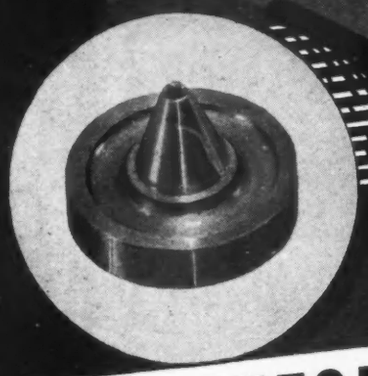

It matters little whether the order calls for a large or a small quantity. Every job receives the same, careful attention.

Perhaps our engineers can suggest a more economical method of making your parts. At any rate, we'll be glad to help. Call or write—Department A.

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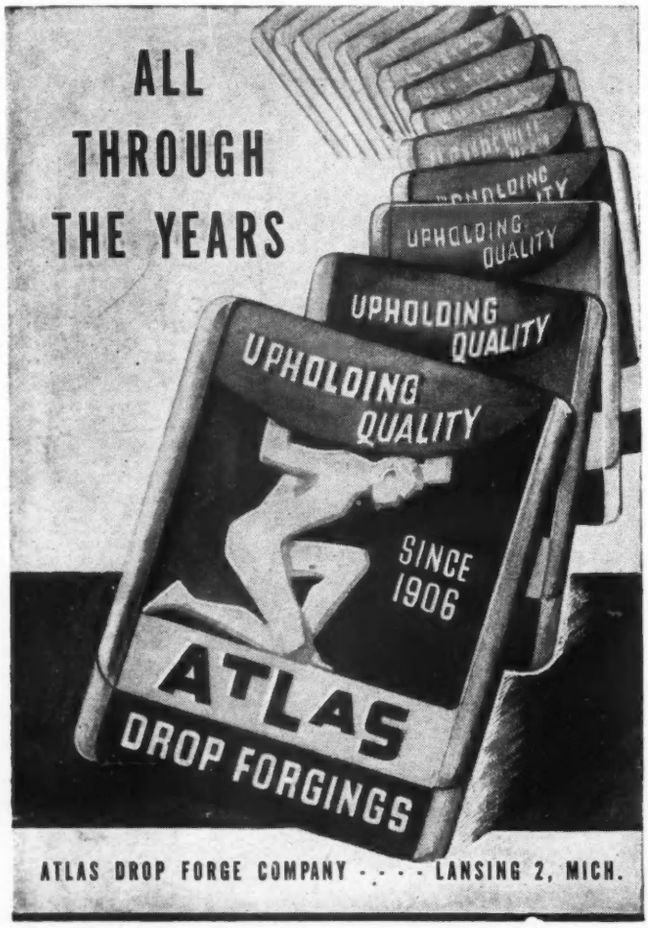
Bar Stock Capacity 3/64" to 5½"

Heat-Treating • Grinding • Plating



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To make the gasoline tank as modern as the rest of the car or truck or bus 15 makes of cars, trucks, buses, and taxicabs now have Scully VENTALARM as original equipment.

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There is also a household type of VENTALARM — installed on the fuel oil tanks in half a million homes.

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How SPEED SAVES MONEY

A production record like this is a challenge to any plant that turns out precision parts in large quantities.

Here is a steel Bearing Race, $3\frac{1}{4} \times 4\frac{5}{8}$", turned from SAE 4620 Tubing. Close concentricity must be held between outside contour and the bored and reamed inside diameter.

An Acme-Gridley $4\frac{3}{4}$" Four Spindle Bar Automatic does the complete job in less than $1\frac{1}{2}$ minutes machine time.

We suggest you compare that with the time it would take to do this job on equipment you now have. More important, if you want a modern-method time estimate on producing a special job of your own, write us about it.

Modern-method time saving is certainly one of the answers to your price competition and larger volume of sales.

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Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

Touch the Button

Fresh air's grand—but for relief from air roar, touch the button.

To say, "Where do I park?" Touch the button.

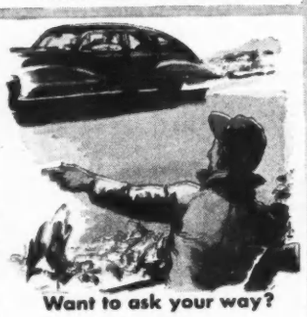
"Too windy back there?" Touch the button.

Want to signal for a turn? Touch the button.

Sudden gust of dust? Touch the button.

Want to pay the gas man? Touch the button.

See a splash coming? Touch the button.

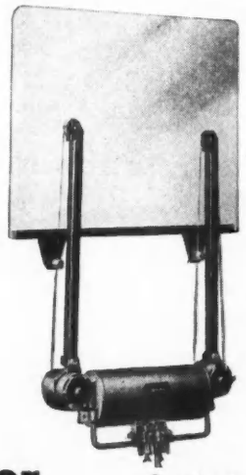


Want to ask your way? Touch the button.

It's easier than flicking the ash to touch the button.

Yes, dozens of times a day—thousands of times a year—you will find Trico Lift-O-Matic one of the biggest conveniences on your motor car. For with Lift-O-Matic, your car window flashes up or down in a split second. Your hand barely leaves the wheel—your eyes never leave the road.

The power which operates it is costless, for it is harnessed air power—the same force which lifts an airplane and keeps it flying. Lift-O-Matic can be installed on all windows—or only on the all-important driver's door. Provision for optional installation may be looked for in the car of tomorrow.



Completely concealed within the door

TRICO *Lift-O-Matic* **Harnessed Air Power**

Touch Button Control of Motor Car Windows . . Trico Products Corporation, Buffalo 3, N. Y.

"I'VE JUST GIVEN MY OLD BUS ITS FIRST SPRING CLEANING

AND TAKE IT FROM ME . . .

nothing equals Stainless Steel!"

RIGHT you are, Sir—and you're not the only car owner who has discovered the same thing.

Nursing cars along to last as long as possible, people have found that the passing years have left their indelible mark on ordinary car trim. In pitting—in hard-to-get-rid-of staining and discoloration—in unsightly rusty spots that no amount of elbow grease will remove. But *not* when Stainless Steel was used.

Hub caps, grilles, window trim and beading made of Stainless Steel have remained just as lustrous and new looking, just as easy to clean, as they were eight and ten years ago.

That's why owners fortunate enough to have Stainless in their old cars are today more sold than ever on Stainless Steel. And so are the others who weren't so lucky.

Today Stainless Steel is tops in popular preference. People *go* for Stainless. Remember this when you plan your cars of tomorrow and remember too, that U·S·S Stainless Steel properly used does not add to the cost—it only looks as though it did.

U·S·S Stainless Steel's exceptional ductility makes difficult forming easy, speeds up fabrication. It can be used in very thin sections that are still strong and won't rust out. Fewer steps are required in finishing. These savings in production costs often make U·S·S Stainless even cheaper to use than less effective materials.

U·S·S Stainless Steel alone won't sell a car—but it certainly makes selling easier. Get in touch with our engineers if you want experienced practical help in its most economical application.

U·S·S STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
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United States Steel Supply Company, Chicago, *Warehouse Distributors*
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UNITED STATES STEEL

6 WAYS WALDES TRUARC RETAINING RINGS IMPROVED GENERAL EXCAVATOR'S FAMOUS "TYPE 10"

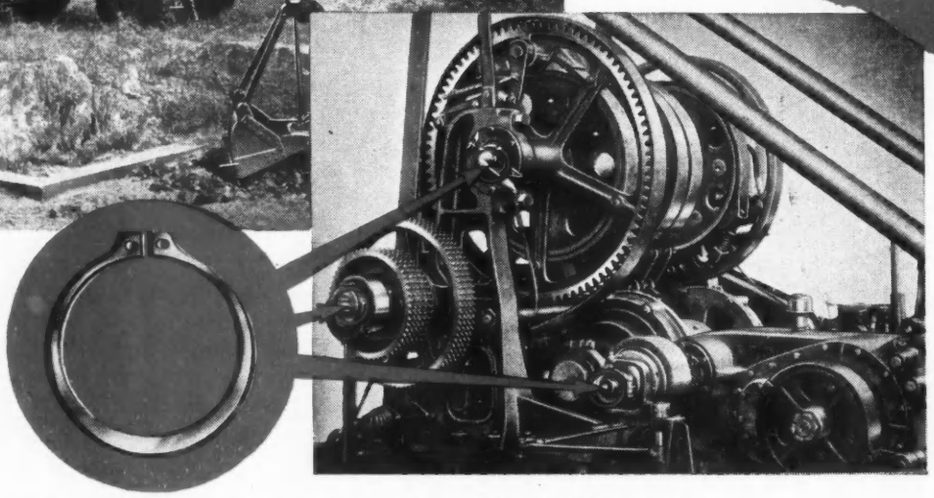
GENERAL EXCAVATOR'S TYPE 10 IN ACTION

An amazing time saving money saving machine. "Type 10" is *precision* equipment—a revolutionary development in excavating machinery. It's one of many products—large and small that have the design economy and greater work efficiency of Truarc rings.

GENERAL EXCAVATOR CO.
Bulletin

Use of Truarc retaining rings on our Type 10, model 105—

1. Gives better integrated construction
2. Simplifies and provides permanently tight assembly on all major shaft assemblies
3. Eliminates bulky lock washers and bolts
4. Speeds production—reduces cost
5. Makes possible greatest design economy with maximum power and efficiency
6. Stands up under the heavy stresses required in our machines



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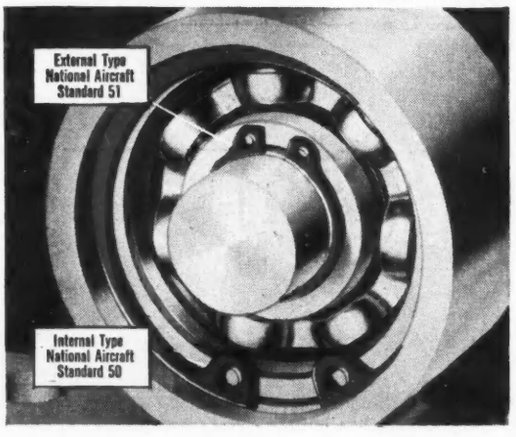
NOW YOUR MACHINES CAN HAVE THE DESIGN ECONOMY of retaining rings regardless of load, stress or accuracy involved. Waldes TRUARC high precision retaining rings do the job of nuts, shoulders, collars, pins and snap rings. Yet they allow lighter, more compact units—make assembly and disassembly quicker, easier. TRUARC retaining rings give *better, more dependable retention* because their mathematical precision means perfect circularity—insures an unfailing grip. There's a Truarc ring for every mechanical purpose.

U.S. PAT. RE. 18,144



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TRADE MARK

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Save Bearings, Machine Hours, Man Hours, Power and Prevent Accidents...

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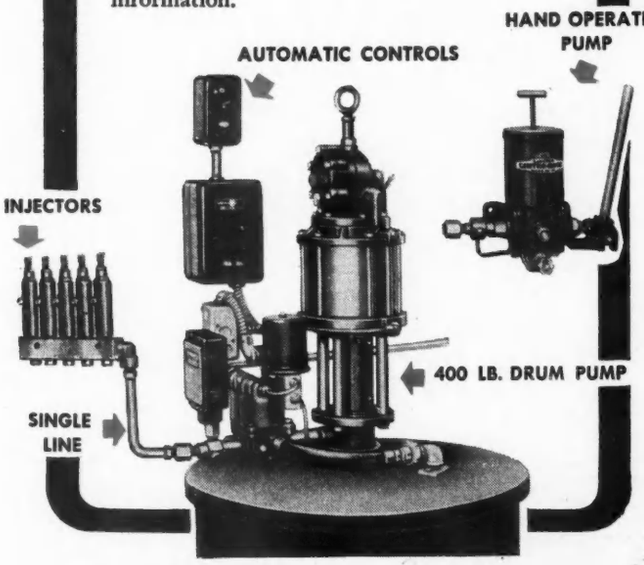
These outstanding centralized systems are designed for simplicity and dependability. They are easy to install on new machines or old machines and consist of a number of injectors — one for each bearing, and a single lubricant supply line from the lubricant pump to each injector. The pump can be time clock or push-button controlled, power operated, or manually operated. One lubricant pump can supply lubricant for a single machine or a battery of machines.

Lincoln Engineering Company maintains a staff of experienced lubrication engineers prepared to assist you with all of your lubricating problems. Mail the coupon for complete information.



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Eliminates many operations.

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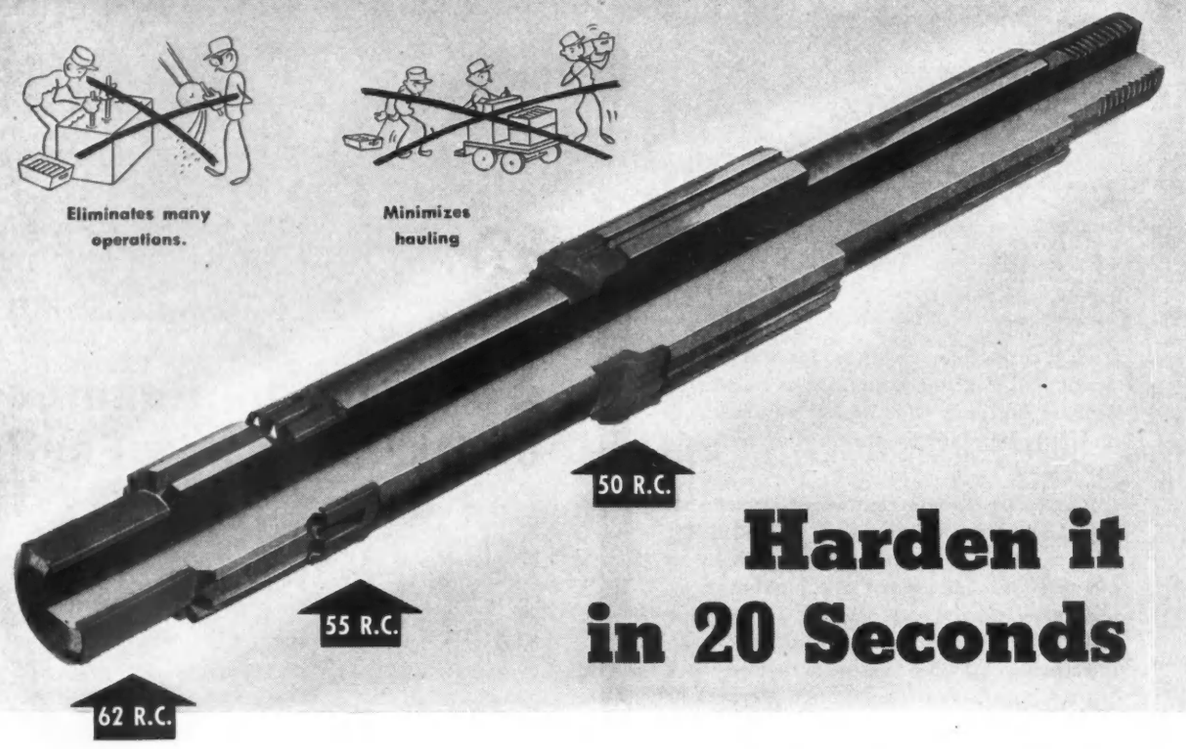

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...better...at lower cost with TOCCO

TO harden three small wearing areas on this transmission shaft by conventional methods requires many complicated operations . . . the heating of the whole piece . . . hours of time.

By the TOCCO Induction Process, you can confine the heating to the three local areas . . . harden all three in 20 seconds . . . each to any desired degree of hardness.

This high-speed surface-treatment does not affect the shaft core; hence there is no compromise between hardness and toughness. The wearing surfaces can have extreme hardness. The core remains strong and ductile. This localized treatment also minimizes warpage . . . eliminates straightening operations.

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The TOCCO Engineer nearby will gladly help you produce *better products at lower cost* with TOCCO Induction Heating. Free bulletin on request.

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OPERATION: Cutting taper, relief, and thread ... smooth finish overall ... on chrome moly (#4130) steel laundry extractor spindles in the plant of WESTERN LAUNDRY MACHINERY CO., North Kansas City, Mo.

With fast powerful drive and smooth vibrationless operation, this LeBlond lathe has cut machining time from 5 hours to 2½ hours, saves Western $6.00 per spindle, and Works Manager C. F. Miles states, "Mirror finish is the best we can do on that LeBlond!"

Formerly, Western Laundry Machinery Co. had to grind each spindle after turning on another lathe. Now, grinding is completely unnecessary and the LeBlond speeds out spindles with only the barest suggestion of a tool mark.

If that kind of turning performance sounds good to you, call in your LeBlond Agent. He'll show you the proper LeBlond lathe for your range of products and he may have the answer to that tough job of yours that, up to now, just hasn't gone fast enough or good enough. Better find out!

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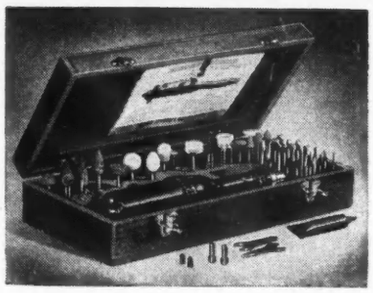

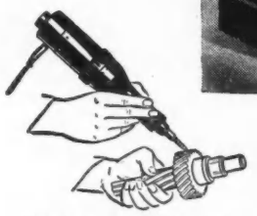

Use alone or mount in stand, vise, or lathe.

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Twice the power and twice the speed of any other electric handtool! Use for faster, smoother work on steel, nonferrous metals, plastics, and most other materials. Speeds up to 35,000 r.p.m. under load reduce frictional wear on mounted wheels by as much as 200%.

Fully cased in durable, lightweight plastic and fully guaranteed shockproof without ground wire on AC or DC. For close jobs attach COOLFLEX Flexible Shaft to extend full power and speed to 9 oz. cool-running hand piece.

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Send for 20 page "Facts and Figures" Booklet.

Precise Products Co.
1344 Clark Street
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THE PRECISE 35

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WITCO Sound Deadeners control vibration noise when sprayed on doors, fenders, deck lids, and other metal areas that cause "road roar". These bituminous mastics also protect metal surfaces against corrosion and abrasion. They are applied with standard mastic spray equipment, without special surface preparation, and satisfy adhesion, ultra-violet, salt spray, and low-temperature tests.

Witco mastics in several types and grades are available for various sound deadening and corrosion problems. Complete data may be obtained by writing Witco Chemical Company.

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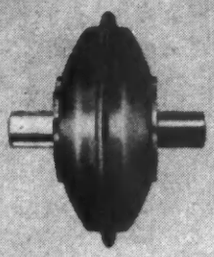

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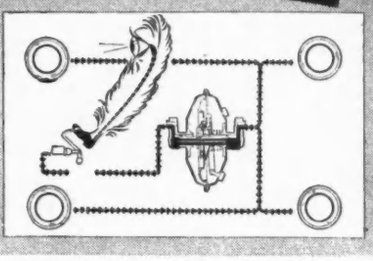

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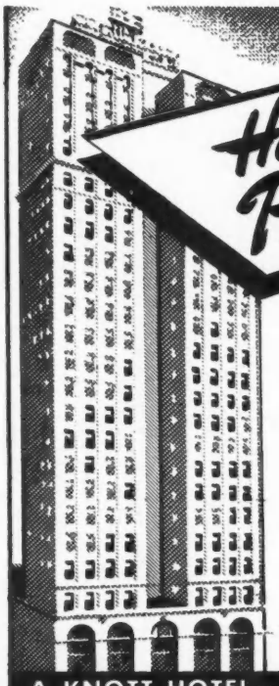

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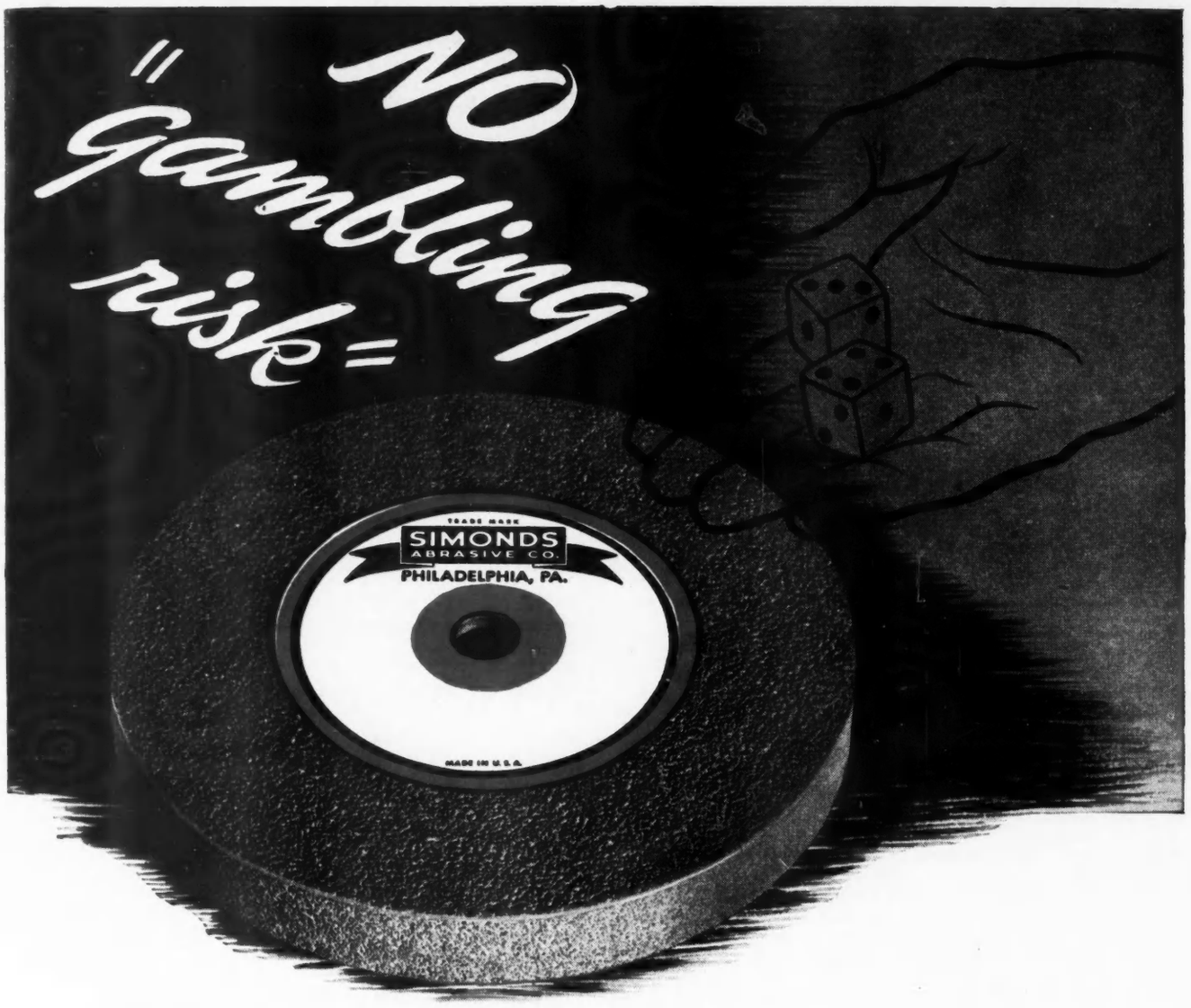

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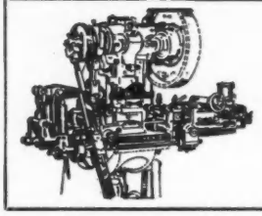

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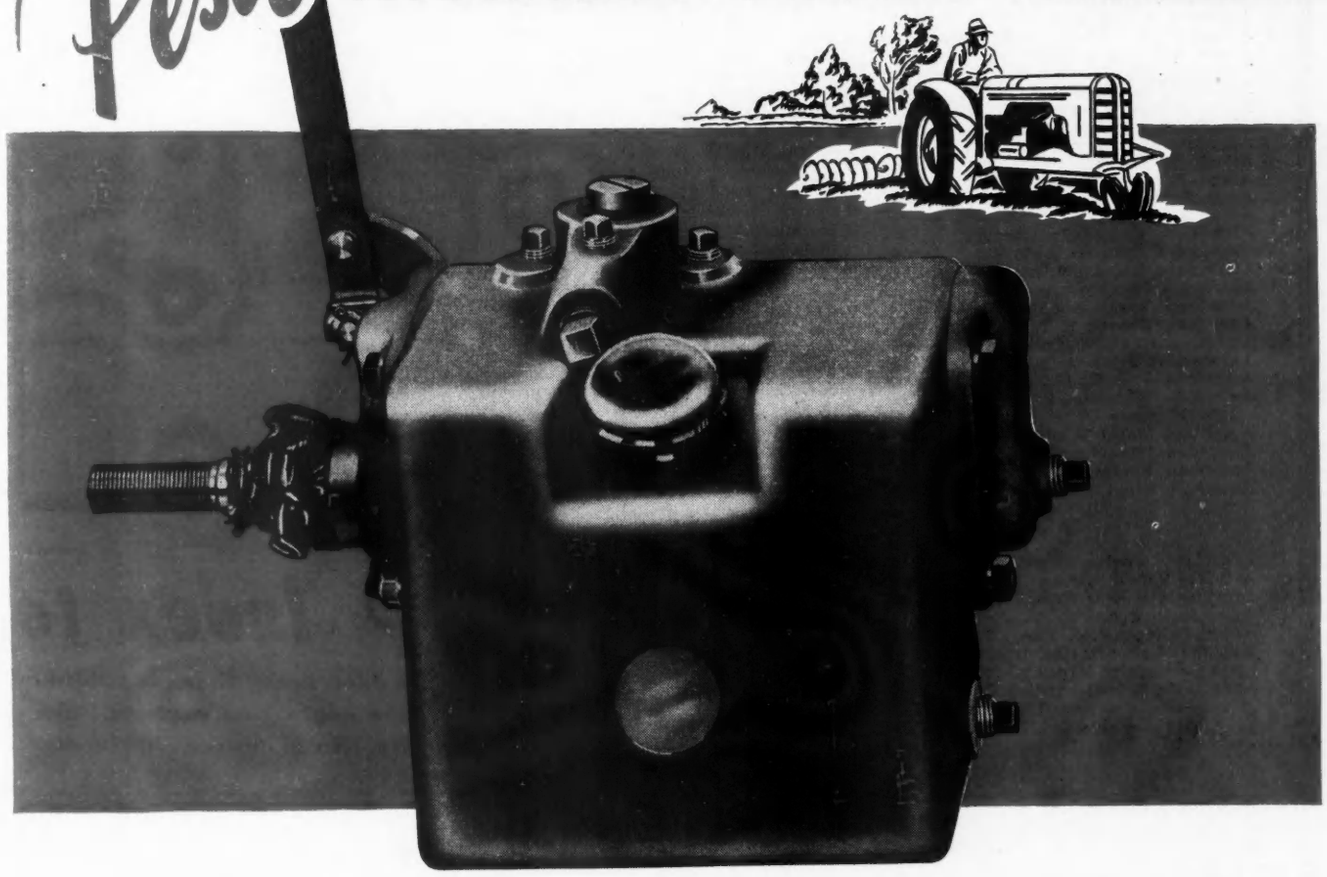

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Affiliated National Hotels 180
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Allegheny Ludlum Steel Corp. ..... —
Allied Products Corp. ..... —
Alloy Steel Div. ..... —
Aluminum Alloys Corp. ..... —
Aluminum Co. of America ..... —
Aluminum Industries, Inc. 69
Aluminum Research Institute 145
American Bosch Corp. ..... —
American Brake Shoe Co. 158
American Broach & Machine Co. . —
American Chain & Cable Co., Inc. 164
American Chemical Paint Co. 106
American Felt Co. 182
American Hammered Piston Ring Div. Koppers Co. 63
American Metal Wks. ..... —
American Phenolic Corp. 123
American Screw Co. 10-11
American Steel & Wire Co. 175
Arkansas Fuel Oil Company ..... —
Armstrong Cork Co. 61
Aro Equipment Corp. ..... —
Associated Spring Corp. ..... —
Atlantic Screw Works ..... —
Atlas Bolt & Screw Co. ..... —
Atlas Drop Forge Co. 172
Atwood Clutch Co., The 94
Austenal Laboratories, Inc. 2
Auto Specialties Mfg. Co. ..... —
Automatic Transportation Co. .... —
Automotive & Aircraft Div. Amer. Chain & Cable Co., Inc. ..... —
Automotive Gear Works, Inc. 135

Bakelite Corp. (Plastic Div.) 118
Baldwin Locomotive Works 109
Bantam Bearings Div., The Torrington Co. ..... —
Barber-Colman Company ..... —
Barnes-Gibson-Raymond Div., Associated Spring Co. ..... —
Bearings Co. of Amer. ..... —
Beaver Gear Works, Inc. ..... —
Bell Telephone Laboratories ..... —
Belle City Malleable Iron Co. 83
Bendix Aviation Corporation
Bendix Products Div. 12
Eclipse Machine Div. ..... —
Zenith Carburetor Div. 152
Bendix-Westinghouse Automotive Air Brake Co. 143
Besly & Co., Chas. H. 148
Bethlehem Steel Co. 150
Birdsboro Steel Fdry. & Mch. Co. . —
Blakeslee & Co., G. S. 184
Bliss & Laughlin, Inc. ..... —
Bohn Aluminum & Brass Corp. 125
Booth Felt Co. ..... —
Borg & Beck Div. Borg-Warner ... 84
Bower Roller Bearing Co. ..... —
Brad-Foote Gear Wks. ..... —
Bridgeport Fabrics, Inc. 121
Bryant Chucking Grinder Co. ..... —
Buell Manufacturing Co. 64
Buffalo Bolt Co. 144
Buhr Machine Tool Co. ..... —
Bullard Co., The ..... —
Bulldog Electric Products Co. .... —
Bundy Tubing Co. 4
Bunting Brass & Bronze Co. ..... —
Burgess-Norton Mfg. Co. ..... —

Campbell, Andrew C., Div. American Chain & Cable Co., Inc. ... —
Campbell, Wyant & Cannon Foundry Co. ..... —
Canfield Co., H. O. ..... —
Carbide & Carbon Chemicals Corp. —
Carboloy Company, Inc. ..... —
Cardox Corp. 149
Carnegie-Illinois Steel Corp. 175
Carpenter Steel Co., The 53
Celanese Corp. of Amer. ..... —
Central Equipment Co. 151
Central Screw Co. 10-11
Central Steel & Wire Co. 14
Chambersburg Engineering Co. ... 122
Chandler Products Corp. 10-11
Chicago Rawhide Mfg. Co. 77
Cincinnati Milling Machine Co. ... —
Cincinnati Tool Co., The ..... —
Cities Service Oil Co. ..... —
Clark Tructractor Div. 66
Clearing Machine Corporation 113
Cleveland Punch & Shear Wks. Co. 136
Cleveland Wire Spring Co. 156
Climax Molybdenum Company 49
Cold Metal Products Co., The ..... —
Colgate Aircraft Corp. ..... —
Columbia Steel Co. 175
Cone Automatic Machine Co., Inc.. —
Consolidated Vultee Aircraft Corp. —
Continental-Diamond Fibre Co. .... —
Continental Die Casting Corp. 127
Continental Plastics Corp. ..... —
Continental Rubber Works ..... —
Continental Screw Co. 10-11
Continental Tool Works ..... —
Corbin Screw Div. 10-11-133
Corning Glass Works Co. 134
Cotta Transmission Corp. ..... —
Crane Packing Co. ..... —
Crescent Truck Co. ..... —
Crucible Steel Co. of Amer. 167
Cullen-Friestedt Co. ..... —
Curtis Pneumatic Mach'ry Div. ..... —

Danly Machine Specialties, Inc. 129
Detrex Corporation 76
Disston & Sons, Inc., Henry 160
Dole Valve Co. 80
Donaldson Co., Inc. 88
Dow Chemical Co., The ..... —
du Pont de Nemours & Co., Inc. 115-131-141
Dykem Co., The ..... —

Eastman Kodak Co. 73
Eaton Mfg. Co. 10-11
Elastic Stop Nut Corp. 140
Electric Auto-Lite Co., The ..... —
Electric Furnace Co., The 92
Electric Storage Battery Co. ..... —
Electrical Engrg. & Mfg. Corp. ... —
Electro Alloys Div. 158
Electro Metallurgical Co. ..... —
Electro Products Laboratories ... —
Empire Electric Brake Co. 182
Ergolyte Manufacturing Company .. —
Essex Wire Corp. 124
Ex-Cell-O Corporation ..... —

Fairfield Mfg. Co. ..... —
Federal Machine & Welder Co. ..... —
Federal-Mogul Corp. ..... —
Federal Press Co., The ..... —
Federal Seal Company ..... —
Felt Products Mfg. Co. 184
Felters Co., The ..... —
Fenwal, Inc. ..... —
Fitzgerald Mfg. Co., The 180
Foote Bros. Gear & Machine Co. .. 162
Ford Motor Co. 81-90
Fuller Manufacturing Co. 132
Fulton Sylphon Co., The 75

G & O Mfg. Co. ..... —
Gairing Tool Co., The ..... —
Galland-Henning Mfg. Co. 68
Gardner Machine Co. ..... —
Garrett Co., Inc., George K. ..... —
Gear Grinding Machine Co. 117
General Controls 168
General Electric Company 120
General Engineering Service 184
General Steel Warehouse Co., Inc. 184
Gibson Company, Wm. D. ..... —
Gisholt Machine Co. 8-101
Gits Bros. Mfg. Co. ..... —
Globe Steel Tubes Co. 163
Goodrich Chemical Co., B. F. (Hycar) 67
Govro-Nelson Co. 182
Great Lakes Steel Corp. 103
Greenlee Bros. & Co. ..... —
Grizzly Manufacturing Co. 72
Gunite Foundries 96

Handy & Harman ..... —
Hansen Mfg. Co., The 119
Hanson-Van Winkle-Munning Co. . —
Harper Co., The H. M. ..... —
Harris Products Company 82
Hayes Industries, Inc. 91
Heald Machine Co., The .....2nd Cover
Hedstrom Industries, Inc. ..... —
Herbrand Corporation, The 60
Hoover Ball & Bearing Co. ..... —
Hotel Pittsburgher 132
Houghton & Co., E. F. ..... —
Howell Electric Motors Co. ..... —
Hupp Motor Car Corp. 153
Hyatt Bearings Div. 7
Hydraulic Press Mfg. Co., The Back Cover
Hydropress, Inc. ..... —

Indiana Gear Works 166
Industrial & Marine Div., Ford Motor Co. 81
Inland Steel Company 47
International Nickel Co., Inc., The. —
International Screw Co. ..... —

J & L Steel Barrel Co. 13
Jack & Heintz Precision Industries, Inc. 70-71
Jacobs Co., F. L. ..... —
Jessop Steel Company 85
Jo Manufacturing Company ..... —
Johansson Div. Ford Motor Co. 90
Johnson Bronze Co. 89
Johnson Products, Inc. 102
Johnson Rubber Co., The ..... —
Jones & Lamson Machine Co. ..... —
Jones & Laughlin Steel Corp. ..... —

Index to

The Advertisers' Index is published of the advertising contract. Every rectly. No allowance will be made

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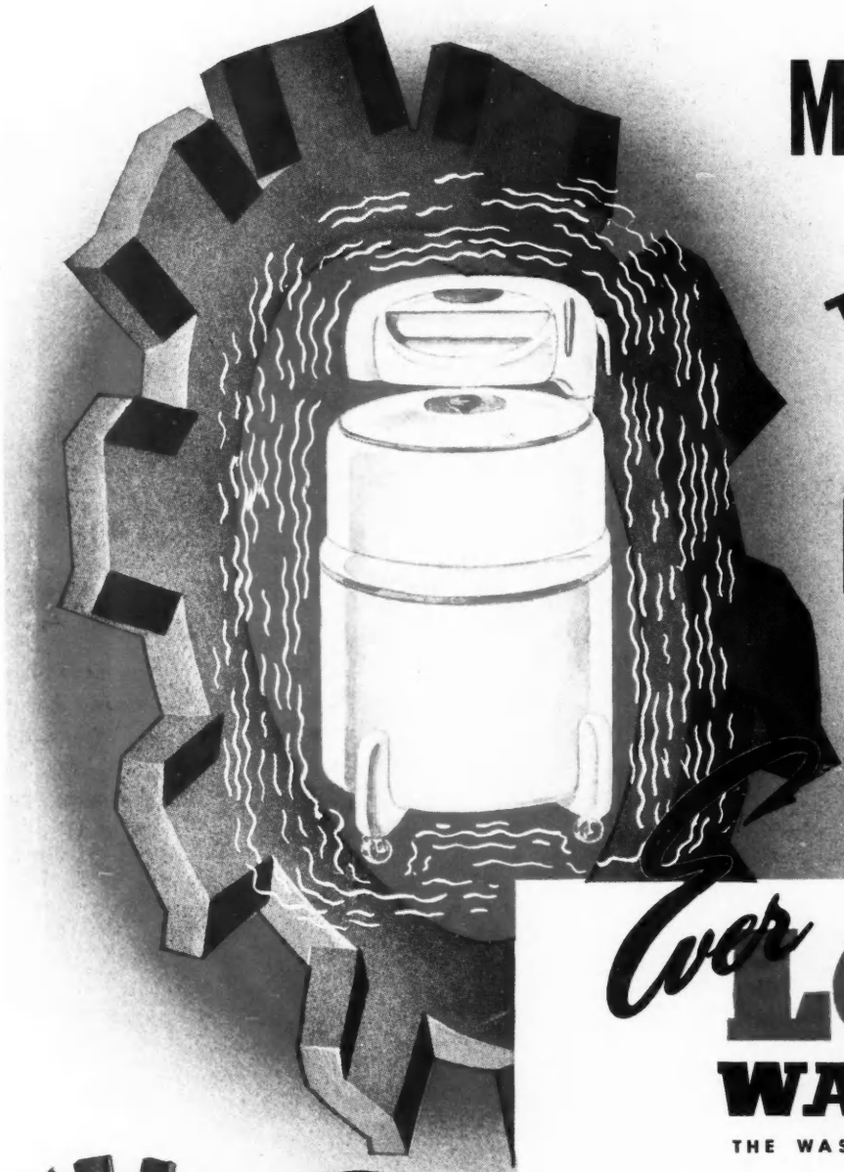

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